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Memorandum

To: Michael Bellot, EPA Region IX

Thru: Rachel Loftin

Subject: Completed Work

Date: June 14, 1993

cc: Catherine C. Walton, BEI ARCS

Attached is the following completed document:

PA **X** SI _____ Other _____

Site Name: Farm Flite Ag. Service # 4602 7/9/93

EPA ID: CAD 983650078

City, County: Lost Hills, Kern County, Calif.

For EPA Use Only

Latitude: 35° 38' 04.0" N Longitude: 119° 41' 16.5" W

EPA Further Action Determination: NFA PA Complete

Lead Agency: F

Sign Off Date: 7/6/93

Initials of ~~Work Assignment Manager:~~ SAM: MEB

Document Screening Coordinator: MWJ 7/6/93

Chief, Site Evaluating and Grants Section: TBS 7/6/93

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FINAL EPA File Copy

Preliminary Assessment

Site: Farm Flite Ag. Service
Lost Hills Airport
Lost Hills, CA 93249

Site EPA ID Number: CAD 983650078

Work Assignment Number: 60-15-9J00, ARCSWEST Program

Submitted to: Michael Bellot, EPA Region IX

Thru: Rachel Loftin

Date: June 14, 1993

Prepared by: Jordie Bornstein JB

Review and Concurrence: Catherine C. Walton, BEI ARCS CW

1.0 INTRODUCTION

The U.S. Environmental Protection Agency (EPA), Region IX, under the authority of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and the Superfund Amendments and Reauthorization Act of 1986 (SARA), has tasked Bechtel Environmental, Inc. (BEI) to conduct a preliminary assessment (PA) of Farm Flite Ag. Service (Farm Flite) in Lost Hills, Kern County, Calif.

The purpose of the PA is to review existing information on the site and its environs to assess the threat(s), if any, posed to public health, welfare, or the environment and to determine if further investigation under CERCLA/SARA is warranted. The scope of the PA includes the review of information available from federal, state, and local agencies and performance of an onsite reconnaissance visit.

Using these sources of existing information, the site is then evaluated using the EPA's Hazard Ranking System (HRS) criteria to assess the relative threat associated with actual or potential releases of hazardous substances at the site. The HRS has been adopted by the EPA to help set priorities for further evaluation and eventual remedial action at hazardous waste sites. The HRS is the primary method of determining a site's eligibility for placement on the National Priorities List (NPL). The NPL identifies sites at which the EPA may conduct remedial response actions. This report summarizes the findings of these preliminary investigative activities.

Farm Flite was identified as a potential hazardous waste site and entered into the Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) on October 19, 1992 (CAD 983650078) (1).

1.1 Apparent Problem

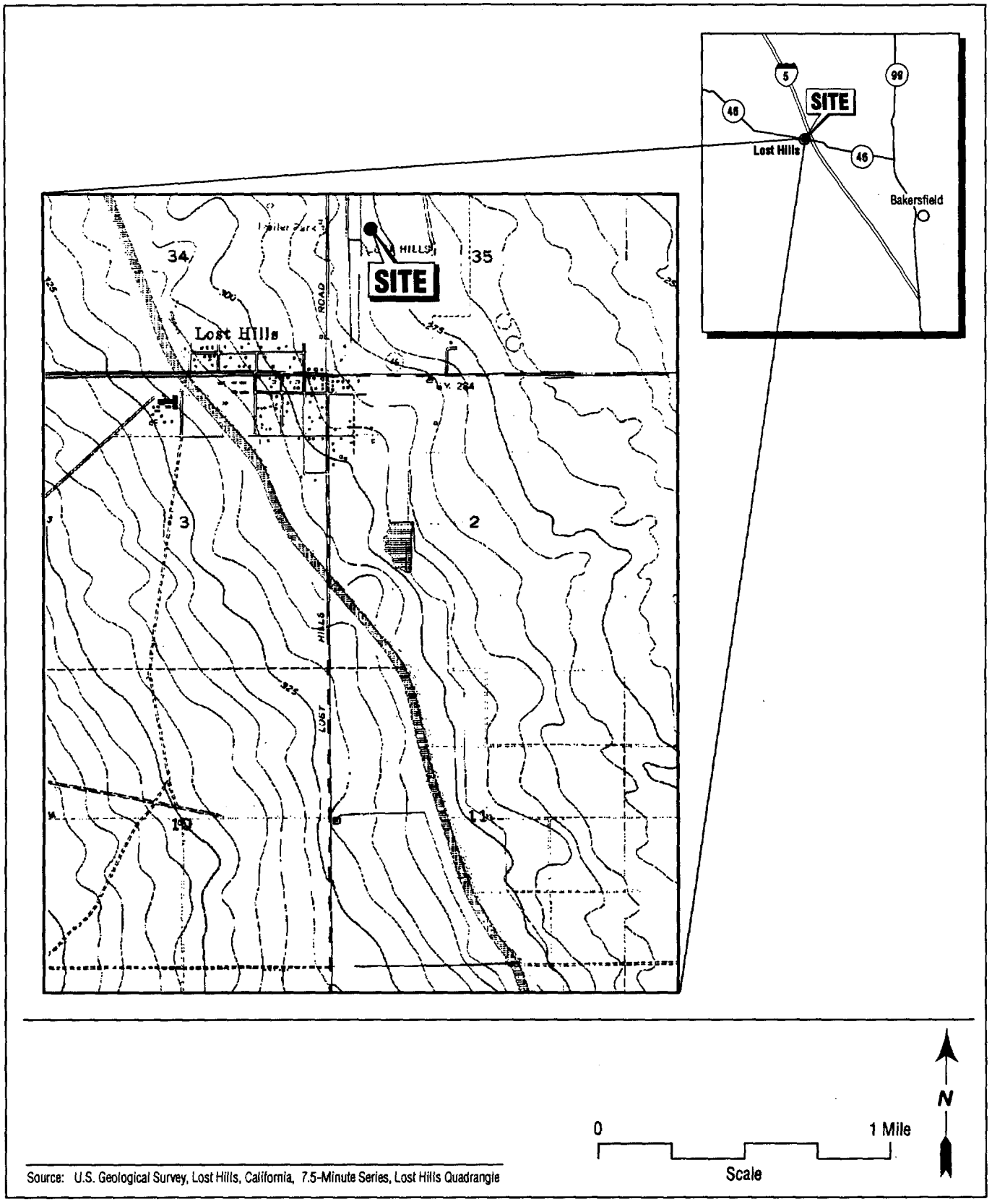
The apparent problem at the site is as follows:

- The exteriors of airplanes used for pesticide application have been rinsed on the onsite runway and concrete apron, since at least 1979 (2). Historically, rinsewater from washing operations was disposed of through an underground conduit to a leach field and was later discharged into two dry wells on site. (3) Soils and groundwater may have been contaminated.

2.0 SITE DESCRIPTION

2.1 Location

The site is located at the Lost Hills Airport, approximately 0.25 mile northeast of Lost Hills, Calif. (4). The geographic coordinates for the site are 35° 38' 04.0" N latitude and 119° 41' 16.5" W longitude (Township 26 South, Range 21 East, Section 35, Mount Diablo Baseline and Meridian, Lost Hills, Calif., 7.5-minute quadrangle) (5). The location of the site is shown in Figure 2-1.



Source: U.S. Geological Survey, Lost Hills, California, 7.5-Minute Series, Lost Hills Quadrangle

CG1/Farm Flite/330p

Figure 2-1 Site Location

2.2 Site Description

The site occupies approximately 381 acres in a rural area approximately 0.25 mile northeast of Lost Hills, Calif. at the Lost Hills Airport (4, 6). The Lost Hills Airport is a non-commercial airport predominantly used by aerial pesticide applicator operations. The site is bordered by Lost Hills Road on the west, State Highway 46 on the south, and agricultural lands on the north and east. Lost Hills Park and a fire station are adjacent to the site in the southwest corner. A trailer park is opposite Lost Hills Road west of the site. (4)

Two entrances off of Lost Hills Road lead to separate leasable areas of the site, a southern leasable parcel and a northern leasable parcel. In addition, the site includes vacant grassy lands between the two parcels, a 3,000-foot concrete runway, and a concrete apron. The site is completely fenced and predominantly covered by grassy fields, except for buildings or roads. (4) The site layout is shown is Figure 2-2.

The southern leasable parcel is a 9,000-square-foot property which has been sublet by a drilling mud company since June of 1991. The drilling mud company maintains an office building, a trailer, two storage sheds, and a number of mud and water storage and mixing tanks on the parcel. The ground cover in the vicinity of these buildings and tanks consists of exposed soils and gravels. (4)

The northern leasable parcel consists of a 150,000-square-foot property located to the west of the airport runway and concrete apron, and to the east of Lost Hills Road (6). Currently this parcel contains two airplane hangars, a trailer, and a 10,000-gallon underground tank used to store aviation fuel (6, 7). From 1979 until 1983, a trailer was used to store empty, triple-rinsed pesticide containers, and was located north of the northern airplane hangar (2, 3). In 1983, a fenced dock also on this parcel was used to store pesticides (3).

Historically, the exteriors of airplanes and other equipment used for aerial pesticide application were rinsed on the concrete apron adjacent to the runway (2, 3). In 1979, rinsewater from these washing operations was discharged through an underground conduit to a leach field (2). Beginning in 1983, the rinsewater was discharged into two dry wells on site (3). The precise locations of these disposal areas are not known, nor could evidence of their existence be found during the 1993 PA investigation.

2.3 Operational History

Farm Flite is located at Lost Hills Airport, one of six airports in the Bakersfield area that is owned and operated by the County of Kern, Department of Airports. The Department of Airports acts as lessor for the two leasable parcels at Lost Hills Airport. In addition, the Department of Airports oversees the activities of all pesticide applicators using the runway. (8)

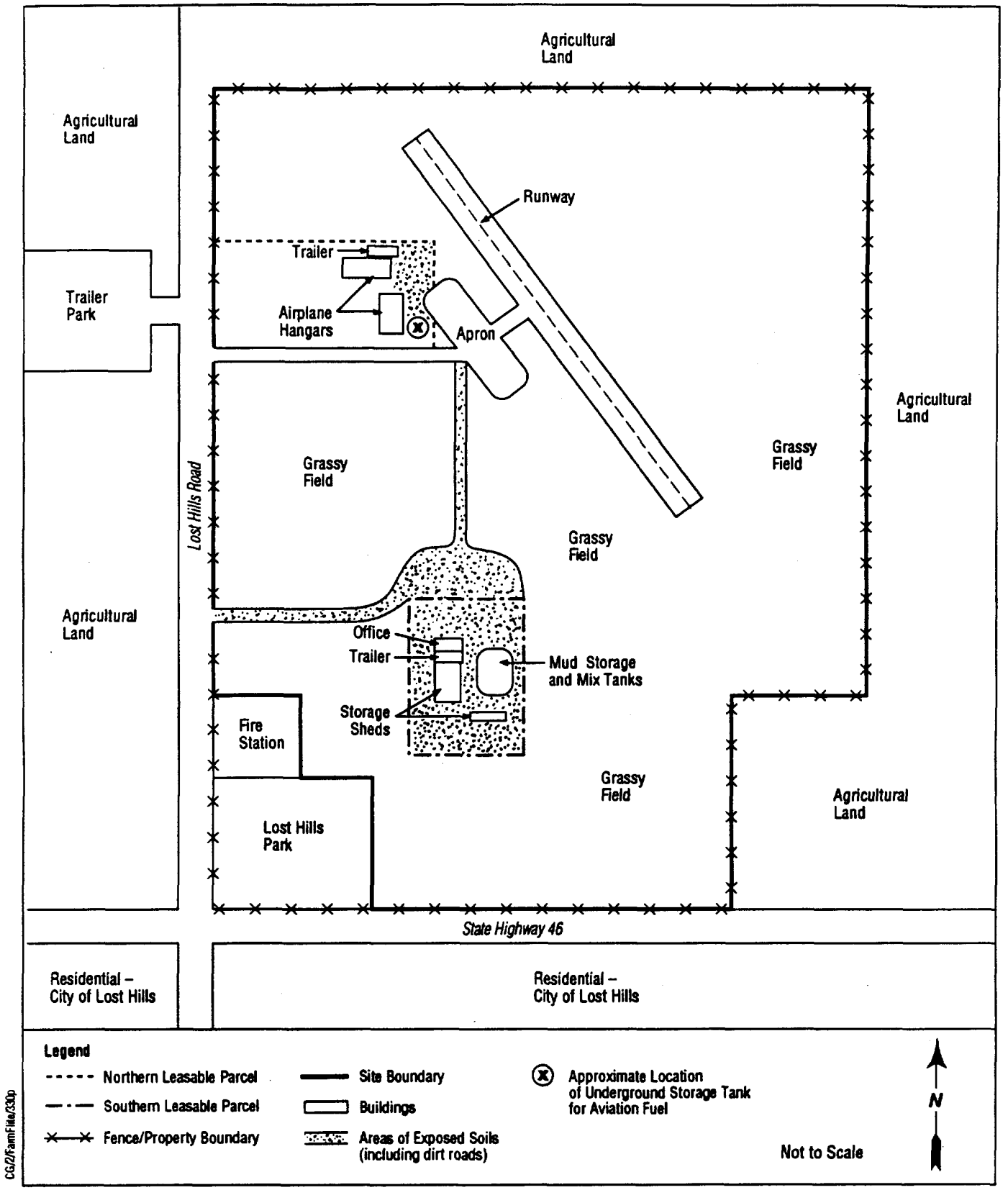


Figure 2-2 Site Layout

- **Northern Parcel**

Lost Hills Flying Service (LHFS), an aerial pesticide applicator business, began leasing the northern parcel in 1979. In 1980, DeRoy Simpson, the owner of LHFS, built the southern airplane hangar that is presently on site. (9) LHFS operated three to four planes for aerial pesticide application. According to an inspection report, dated Nov. 1, 1979, from the Regional Water Quality Control Board (RWQCB), Central Valley Region, LHFS applied a variety of different pesticides and rinsed booms and hopper tanks over the target crops. The inspection report stated that the exterior rinsing of airplanes occurred once per plane each day on the concrete apron adjacent to the runway. Rinsewater was drained to a leach field by way of an underground conduit. Empty, purportedly triple-rinsed containers were stored in a trailer near the northern hangar. The RWQCB inspection report noted that in 1979, the runway was also used by other small pesticide applicators for take-off and landing only. (2) It is uncertain when LHFS ceased operations on the northern parcel. However, the Department of Airports purchased the southern airplane hangar from Nancy Hood (wife of DeRoy Simpson) in 1979 (9). The underground tank, located near the concrete apron, was installed in 1980 and used for storage of aviation fuel until it was emptied in 1992 by the lessee of the southern airplane hangar (4, 7).

Farm Flite, an aerial agricultural-pesticide application business owned by Marion Goolsby and John Gillis, began operations on the northern parcel in 1981. According to a January 20, 1983 Department of Toxic Substances Control (DTSC), (formerly known as the California Department of Health Services, Toxic Substances Control Division) report on Farm Flite, the exteriors of planes and other pesticide application equipment were rinsed on a wash pad. The rinsewater was discharged to two onsite dry wells. Empty triple-rinsed pesticide containers not returned to the farmer were stored in the trailer on site prior to disposal at the Shafter Dump. (3)

In October of 1987, Farm Flite ceased operations on the northern parcel and began to lease the 9,000-square-foot southern parcel. From December 1987 to November 1990, Kaweah Crop Dusters leased the northern parcel and operated an aerial pesticide business. Operational processes and waste management practices for this business are not known. During periods where no lessee is mentioned, the northern parcel was vacant. (9)

Currently, the northern airplane hangar is vacant. The southern airplane hangar is being rented for private aircraft storage and one family is living in the trailer. The runway is being used by eight separate aerial pesticide application companies for take-off, landing, and loading airplanes. (4, 9) According to the present lessee of the southern hangar, there has been a problem with unauthorized planes landing on the runway. No wastes are currently generated by activities in the northern parcel. (4)

No evidence of a leach field, stressed vegetation, or dry wells could be found on the northern parcel during the 1993 site reconnaissance visits. (4) Records from the California Department of Water Resources document that one well in

the northern portion has been destroyed; however, the date of destruction is not known (10, 11).

- **Southern Parcel**

  Farm Flite began leasing the southern parcel in October of 1987. A trailer was installed and a storage shed was constructed on site; both are still on the parcel. (9) In June of 1988, the business had three employees, who operated an office out of the trailer, and used the building for airplane storage. (12) Operational processes and waste management practices in the southern parcel are not known. Information regarding onsite operations prior to October 1987 is not available.

  Since June 1991, Unibar Energy Services (Unibar) has sublet the southern parcel from Farm Flite. Unibar is owned by Anchor Drilling Fluids, a Norwegian-based firm. Company operations consist of mixing drilling fluids, also known as completion fluids, which are used for drilling oil wells. Unibar's customers primarily consist of drillers hired by oil companies. (4)

  Unibar operations consist of mixing of two types of clay-based muds: potassium chloride (KCl) muds and hydroxyl ethyl cellulose (HEC) polymer muds. Materials such as potash, bentonite gel, and barite are added to the mud to increase its viscosity. The mixing process is accomplished by pumping water and the clay-based muds into an open-air mixer and hopper. Antifoam and bactericide are added to the water to inhibit growth of bacteria. After the muds have been mixed, they are pumped to storage tanks to await pickup by clients. (4)

  Unibar currently has five employees: a truck driver, an engineer, two people who mix muds, and a manager. Unibar conducts business from 7 a.m. to 3 p.m., 5 days a week, delivering muds directly to the clients' rigs. Drillers are also able to drive trucks on site 24 hours a day to obtain mud on an as-needed, self-serve basis. Trucks are not rinsed between deliveries, so no rinsewater is generated on site. Because all chemicals, additives and muds are combined and sold to clients as a product, no wastes accumulate on site. Clients purchasing the muds are responsible for disposal of the fluids as spent wastes after their use. (4)

2.4 Regulatory Involvement

2.4.1 U.S. Environmental Protection Agency. The site is not listed in the Resource Conservation and Recovery Information System (RCRIS) database, dated January 19, 1993 (13).

2.4.2 California Environmental Protection Agency.

California Regional Water Quality Control Board (RWQCB), Central Valley Region. On October 10, 1979, the RWQCB conducted a flyby inspection of LHFS, in the northern parcel of Lost Hills Airport. The inspection was conducted to determine pesticide-rinsewater management processes on site. The inspection was part of a larger investigation into rinsewater disposal practices at all facilities operated by the Department of Airports in response to recently adopted

pesticide-rinsewater guidelines. During the inspection, the RWQCB inspector met with LHFS owner, DeRoy Simpson. The inspection found that airplane exteriors were rinsed on a concrete apron, and the rinsewater was discharged to a leach field through an underground conduit. The RWQCB inspection concluded that LHFS appeared to be in compliance with pesticide-rinsewater guidelines. The inspection also recommended a follow-up inspection to ascertain whether rinsewater discharged to the leach field was pesticide-free. (2)

Department of Toxic Substances Control (DTSC). The DTSC, formerly known as the Department of Health Services, Toxic Substances Control Division, identified Farm Flite from a phone book in October 1982. In December 1982, the DTSC searched the RWQCB files for information on the site. (14)

On January 20, 1983, DTSC conducted a site inspection of Farm Flite on the northern parcel at Lost Hills Airport to review Farm Flite's past and present waste management practices. During the inspection, the DTSC representative met with the facility operator, Marion Goolsby, and a pilot. The inspection found that exteriors of planes and other equipment were rinsed off on a concrete pad, and that rinsewater was discharged to two dry wells on site. The DTSC inspection recommended that the facility be referred to the RWQCB for further action concerning discharge of rinsewater to the two dry wells. (3)

On June 29, 1988, the DTSC completed an abandoned site drive-by record for Farm Flite. Photos from the drive-by show that Farm Flite was situated on the southern parcel of Lost Hills Airport at this time. The drive-by record also noted that no hazardous wastes were observed at the facility. (12)

2.4.3 County of Kern.

Department of Airports. The Department of Airports is the owner and operator of the Lost Hills Airport (8). In July of 1987, the Department of Airports notified the Kern County Health Department that approximately 725 pounds of chemicals had been abandoned at the Lost Hills Airport. No spillage had occurred and all of the chemical product was present in 16 separate containers. The Department of Airports determined the chemicals were predominantly pesticide products, currently being applied by local agricultural operators. The Department of Airports decided to transfer the chemicals to Kaweah Crop Dusters, which indicated it could use the materials in its spraying operations in the northern parcel. (15)

The Department of Airports has maintained files on historic and present lessees and has ultimate authority over all activity occurring at the airport. (8) In addition, the Department of Airports conducts occasional inspections of the site (4).

Resource Management Agency, Environmental Health Services Department (EHSD). The EHSD is responsible for issuing the permits to operate an underground hazardous substances storage facility at Lost Hills Airport (7, 16). The EHSD has conducted routine inspections of the northern parcel at Lost Hills Airport since 1991. These inspections are primarily conducted to ensure the 10,000-gallon underground storage tank used to store aviation fuel is maintained. (17) Inspection reports were completed in February 1991 and March 1992 (18, 19). A Phase I Vapor Recovery Inspection form was completed for the underground storage tank by an EHSD employee in February 1991 for the Kern County Air Pollution Control District. (19)

Department of Agriculture. The Department of Agriculture conducted a pesticide-storage site inspection of Farm Flite on July 12, 1990 (20). The inspection resulted in a notice of violation dated July 23, 1990 for improper storage of pesticide containers (21). The Department of Agriculture conducted a follow-up inspection on August 2, 1990 and determined that pesticide storage on site was in compliance (22).

Lost Hills Fire Department. The Lost Hills Fire Department conducts routine inspections of buildings at the Lost Hills Airport to ensure compliance with fire and safety regulations. The fire department maintains inspection reports for two years. These reports showed no record of any violations or hazards at Lost Hills Airport. (23)

3.0 HAZARD RANKING SYSTEM FACTORS

3.1 Sources of Contamination

Potential sources of contamination include onsite contaminated soils. Historically, rinsewater from exterior washing of planes and other equipment used for aerial pesticide application was discharged to a leach field and into two dry wells on site (2, 3).

3.2 Groundwater Pathway

The site is situated on the Antelope Plain, 10 miles south of the Tulare Lake bed in the southwest portion of California's San Joaquin Valley. The San Joaquin Valley is bordered on the east by the Sierra Nevada Mountains and on the west by the Coast Range. (24) Groundwater in the western side of the valley, south of the Tulare Lake bed is generally high in total dissolved solids and consequently is not used for drinking water or irrigation. (24, 25) Groundwater beneath the site generally flows to the southwest and occurs at approximately 50 feet below ground surface (bgs). (25)

The Lost Hills Municipal Utilities District distributes drinking water to the Lost Hills area through 200 connections (26). The water is imported from wells located 13 miles to the east of Lost Hills (27). No drinking water wells are within 4 miles of the site (11). Files at the Department of Water Resources indicate that, historically, there were three private wells within 1 mile of the site. However, two of the three are documented as destroyed and the other is listed as abandoned. (10, 11) The wells were used by cattle herders for watering stock as they passed through the area (11).

Although there is potential for release of hazardous substances from the site to groundwater, groundwater in the vicinity is not used for drinking water or irrigation (25).

3.3 Surface Water Pathway

The nearest surface water body is the California Aqueduct, 1 mile west of the site. The aqueduct flows from north to south and is concrete-lined, fenced and generally inaccessible to the public (28). Although flow rates for the aqueduct vary from a maximum of 5,000 cubic-feet per second (cfs) to a minimum of 400 cfs, on average, the aqueduct conveys water at 3,000 cfs (29). No drinking water intakes are associated with the California Aqueduct within 15 miles downstream of

the site (24). Although instances of illegal access and fishing have occurred at the aqueduct, it is, as noted above, generally inaccessible to the public (30).

The Kern River Channel is 2 miles east of the site and is an overflow channel that receives Kern River water only during extremely high flows or after occasional wet winters (10, 31). The Kern River Channel has been dry for the past 5 or 6 years, and due to its intermittent nature, its flow rate is not adequate for irrigation and/or recreational fishing purposes (30, 31).

Stormwater runoff from the site tends to puddle and evaporate or percolate down into soils (4). The site is in Flood Zone C, with a flooding frequency greater than 500 years (32). The 2-year, 24-hour rainfall event for the region is 0.9 inch (33).

3.4 SOIL EXPOSURE AND AIR MIGRATION PATHWAY

*3.4.1. **Physical Conditions.*** Exposed soils on site may be contaminated with pesticides from historic equipment and airplane rinsing operations. The majority of the site is covered by grassy fields, except where there are buildings, a runway, and roads. Exposed soils and dirt roads exist in the southern leasable parcel where Unibar currently operates. Although the site is accessible through two entrances off Lost Hills Road, it is completely fenced and the entrances are gated. (4)

*3.4.2 **Soil Exposure Targets.*** The population on site includes five full-time employees of Unibar and one family of four who live in a trailer on the northern leasable parcel (4, 34). In addition, a mobile home park with approximately 100 trailers is within 0.25 mile of the site. The population within 1 mile of the site is 1,212 (4, 35). No schools or daycare centers are on or within 200 feet of the site (4).

The site may be a habitat for two species listed as federally endangered: the blunt-nosed leopard lizard and the Tipton kangaroo rat (30, 36).

*3.4.3 **Soil Exposure and Air Pathway Conclusions.*** There is potential for onsite exposure or release to air. Exposed soils on site may be contaminated with pesticides from historic equipment and airplane rinsing operations. However, the site is in a sparsely populated rural area and is fenced on all sides.

4.0 EMERGENCY RESPONSE CONSIDERATIONS

The National Contingency Plan [40 CFR 300.415 (b) (2)] authorizes the EPA to consider emergency response actions at those sites which pose an imminent threat to human health or the environment. For the following reasons a referral to Region IX's Emergency Response Section does not appear to be necessary:

- The site is fenced, in a rural area, and generally inaccessible to the public.

5.0 SUMMARY

Farm Flite Ag. Service is located at the Lost Hills Airport, approximately 0.25 mile from Lost Hills, Kern County, Calif. The entire site is owned and operated by the County of Kern, Department of Airports. The northern leasable parcel on site contains a runway, two airplane

hangars, a trailer, a 10,000-gallon underground storage tank, and a concrete apron. The runway and a concrete apron are used by a number of small aerial-pesticide application businesses, one hangar is vacant, and the other hangar is being rented out for airplane storage. A family currently occupies one of the trailers on site. Unibar, a drilling mud company located in the southern leasable parcel on site has five employees and does not generate any hazardous substances. The remainder of the site is predominantly covered by grassy fields, and fenced on all sides.

Historically, the exteriors of airplanes and other equipment used for aerial pesticide application were rinsed on the concrete apron in the northern portion of the site. In 1979, a flyby site inspection conducted by the California Regional Water Quality Control Board, Central Valley Region, found that rinsewater from these washing operations was being discharged through an underground conduit to a leach field. In 1983, a site inspection conducted by the Department of Toxic Substances Control found that rinsewater was being discharged into two dry wells. No evidence of a leach field on site could be found in agency files or during the 1993 preliminary assessment site reconnaissance. Records from the California Department of Water Resources document one well in the northern portion of the airport that has been destroyed.

Groundwater beneath the site occurs at approximately 50 feet below ground surface. However, local groundwater is high in total dissolved solids and therefore not used for drinking water or irrigation in the vicinity of Lost Hills. No known drinking water wells are within 4 miles of the site. Drinking water is supplied by the Lost Hills Municipal Utilities District, which obtains water from wells 13 miles east of Lost Hills.

The nearest surface water body is the California Aqueduct, which is 1 mile west of the site. The aqueduct is fenced, concrete-lined, and generally inaccessible to the public. The habitats for two federally endangered species, the blunt nosed leopard lizard and the Tipton kangaroo rat, may be potentially on site.

The majority of the site is covered by grassy fields except where there are buildings, a runway, and roads. The population on site includes five full-time employees of Unibar and one family of four. Although the site is accessible through two entrances off Lost Hills Road, it is in a sparsely populated area, which is completely fenced with gated entrances. No schools or daycare centers are on or within 200 feet of the site. The population within 1 mile of the site is 1,212.

The pertinent Hazard Ranking System factors for the site are as follows:

- Although there is potential for release of site-related contaminants to groundwater, this water is not currently used for drinking water or irrigation.
- The only perennially flowing surface water body within 2 miles of the site is the California Aqueduct, which is fenced and concrete-lined. No drinking water intakes are associated with the canal for 15 miles downstream of the site.
- The site is fenced and located in a rural agricultural area. Approximately 1,212 people live within 1 mile of the site.

REMEDIAL SITE ASSESSMENT DECISION - EPA REGION IX

Site Name: FARM FLITE AG. SERVICE **EPA ID#:** CAD 983650078

Alias Site Names: LOST HILLS FLYING SERVICE

City: LOST HILLS **County or Parish:** KERN COUNTY **State:** CA

Refer to Report Dated: 6/14/93 **Report type:** PRELIMINARY ASSESSMENT

Report developed by: Bechtel Environmental, Inc.

DECISION:

| | 1. **Further Remedial Site Assessment under CERCLA (Superfund) is not required because:**

| ✓ | 1a. Site does not qualify for further remedial site assessment under CERCLA (Site Evaluation Accomplished - SEA)

| | 1b. Site may qualify for further action, but is deferred to: | | RCRA | | NRC

| | 2. **Further Assessment Needed Under CERCLA:** 2a. (optional) Priority: | | Higher | | Lower

2b. Activity Type: | | PA | | ESI | | SI | | HRS evaluation | | Other: _____

DISCUSSION/RATIONALE:

Report Reviewed, Approved, and Site Decision Made by: Michael E. Bellot **Signature:** Michael E. Bellot **Date:** 7/6/93

APPENDIX A

REFERENCE LIST

Site: Farm Flite Ag. Service

1. U.S. Environmental Protection Agency, Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS), February 1, 1993.

2. Baldwin, William D., California Regional Water Quality Control Board, Region 5, Letter to L. Dale Mills (with attached Memorandum Inspection Report), Department of Public Works, July 31,1980.

3. Department of Health Services, Report of Inspection of Farm Flite Ag. Service (with attached Active Site Inspection Checklist) completed by Debbie Small, January 20, 1983.

4. Bornstein, Jordie, Bechtel Environmental, Inc., Site Reconnaissance Interview and Observations Report, March 25, 1993.

5. U.S. Geologic Survey, Lost Hills Quadrangle, California-Kern Co., 7.5-Minute Series (topographic), Photorevised 1973.

6. Kern County Public Works Department and County Surveyor, Airport Layout Plan, Lost Hills Airport, October 1974.

7. Kern County Environmental Health Services Department, Permit to Operate Underground Hazardous Storage Facility (with attached maps showing location) issued to Lost Hills Flying Service, Issue Date: September 23, 1991, Expiration Date: September 23, 1996.

8. Anderson, Ted, County of Kern, Department of Airports, Telephone conversation recorded on Contact Log by Jordie Bornstein, Bechtel Environmental, Inc., March 4, 1993.

9. Day, Frank, County of Kern, Department of Airports, Telephone conversation recorded on Contact Report by Jordie Bornstein, Bechtel Environmental, Inc., April 5, 1993.

10. California Department of Water Resources, Undated map showing water well locations in the vicinity of the Lost Hills Airport received from Dennis Williams, April 26, 1993.

11. Williams, Dennis, California Department of Water Resources, Telephone conversation recorded on Contact Log by Jordie Bornstein, Bechtel Environmental, Inc., May 10, 1993.

12. Department of Health Services, Abandoned Site Program Drive-By Record (with attached Field Photograph Log Sheet) completed by Astrid Johnson, June 29, 1988.

13. U.S. Environmental Protection Agency, Resource Conservation and Recovery Act Notifiers List, Region IX Database, January 19, 1993.

REFERENCE LIST (Cont'd)

Site: Farm Flite Ag. Service

14. Department of Health Services, Abandoned Site Project Final Disposition (with attached Site Information and Prioritization Criteria) completed by Debbie Small, February 7, 1983.

15. Galindo, Lawrence, County of Kern, Department of Airports, Memorandum to Richard Casagrande, August 27, 1987.

16. Kern County Health Department, Application for Permit to Operate Underground Hazardous Substances Storage Facility forms, June 1, 1987 and February 4, 1988.

17. Houghton, Barbara, Kern County Resource Management Agency, Environmental Health Services Department (EHSD), Telephone conversation recorded on Contact Report by Jordie Bornstein, Bechtel Environmental, Inc., April 5, 1993.

18. Houghton, Barbara, EHSD, Leter to Frank Day, County of Kern, Department of Airports (with attached Hazardous Substance Storage Facility Inspection Report), April 3, 1992.

19. Houghton, Barbara, EHSD, Letter to Frank Day, County of Kern, Department of Airports (with attached Hazardous Substance Storage Facility Inspection Report and Phase I Vapor Recovery Inspection Form) February 22, 1991.

20. Kern County Department of Agriculture, Pesticide Use Monitoring Inspection Report completed by David J. Moore, July 12, 1990.

21. Kern County Department of Agriculture, Notice of Violation No. 004866, July 23, 1990.

22. Kern County Department of Agriculture, Pesticide Use Monitoring Inspection Report completed by Richard White, August 2, 1990.

23. O'Kelly, Brian, Kern County Fire Department, Telephone conversation recorded on Contact Report by Jordie Bornstein, Bechtel Environmental, Inc., April 8, 1993.

24. Page, R.W., U.S. Geological Survey Professional Paper 1401-C, Geology of the Fresh Ground-Water Basin of the Central Valley, California, with Texture Maps and Sections, Regional Aquifer-System Analysis, 1986.

25. Haslebacher, Tom, Kern County Water Agency, Telephone conversation recorded on Contact Report by Jordie Bornstein, Bechtel Environmental, Inc., May 4, 1993.

26. Cortez, Estella, Lost Hills Utilities District, Telephone conversation recorded on Contact Report by Jordie Bornstein, Bechtel Environmental, Inc., April 5, 1993.

27. Way, Howard, John Carollo Engineers, Telephone conversation recorded on Contact Report by Jordie Bornstein, Bechtel Environmental, Inc., May 6, 1993.

REFERENCE LIST (Cont'd)

Site: Farm Flite Ag. Service

28. Nixon, Phil, Lost Hills Water District, Telephone conversation recorded on Contact Report by Jordie Bornstein, Bechtel Environmental, Inc., April 7, 1993.

29. Bankston, Dee, California Department of Water Resources, Telephone conversation recorded on Contact Report by Jordie Bornstein, Bechtel Environmental, Inc., April 26, 1993.

30. Heyne, Tim, California Department of Fish and Game, Telephone conversation recorded on Contact Report by Jordie Bornstein, Bechtel Environmental, Inc., April 14, 1993.

31. Williams, Dennis, California Department of Water Resources, Telephone conversation recorded on Contact Report by Jordie Bornstein, Bechtel Environmental, Inc., April 14, 1993.

32. Usfery, John, Kern County Planning Department, Telephone conversation recorded on Contact Report by Jordie Bornstein, Bechtel Environmental, Inc., April 8, 1993.

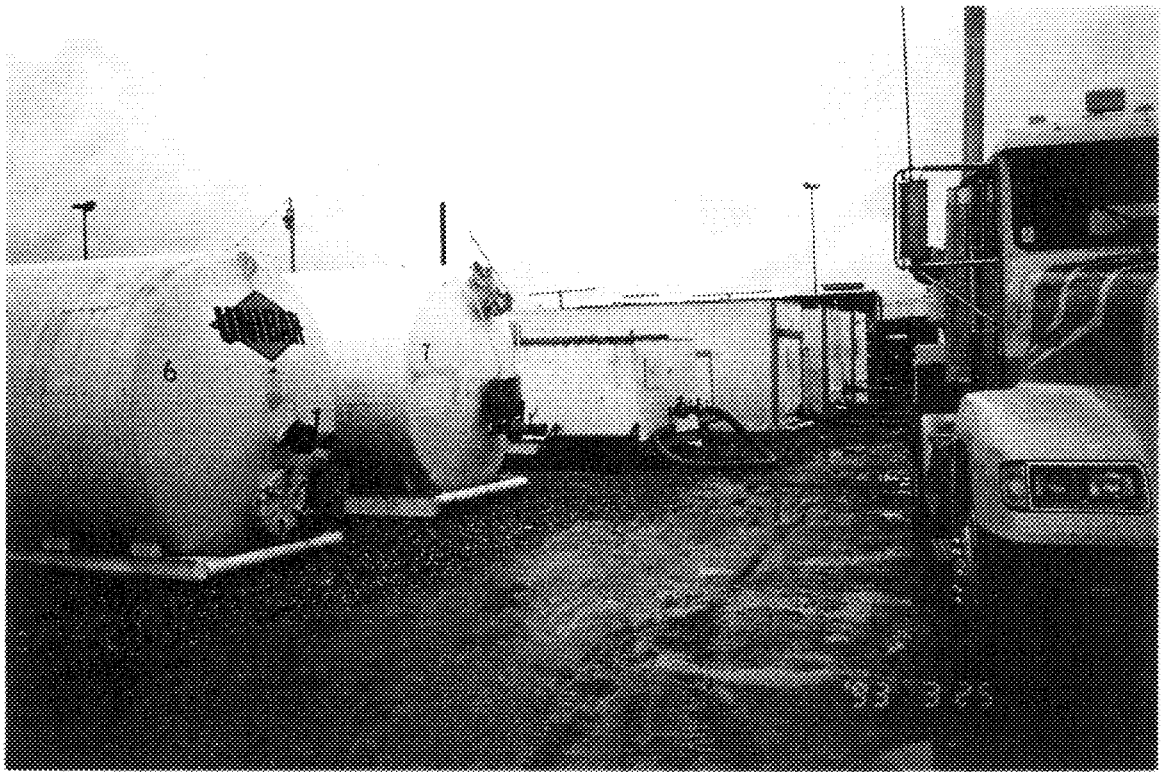
33. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service, Atlas 2, Volume XI, Isopluvials of 2-year, 24-hour precipitation for Southern Half of California in Tenths of an Inch.

34. Mora, Senora, Telephone conversation recorded on Contact Log by Jordie Bornstein, Bechtel Environmental, Inc., April 14, 1993.

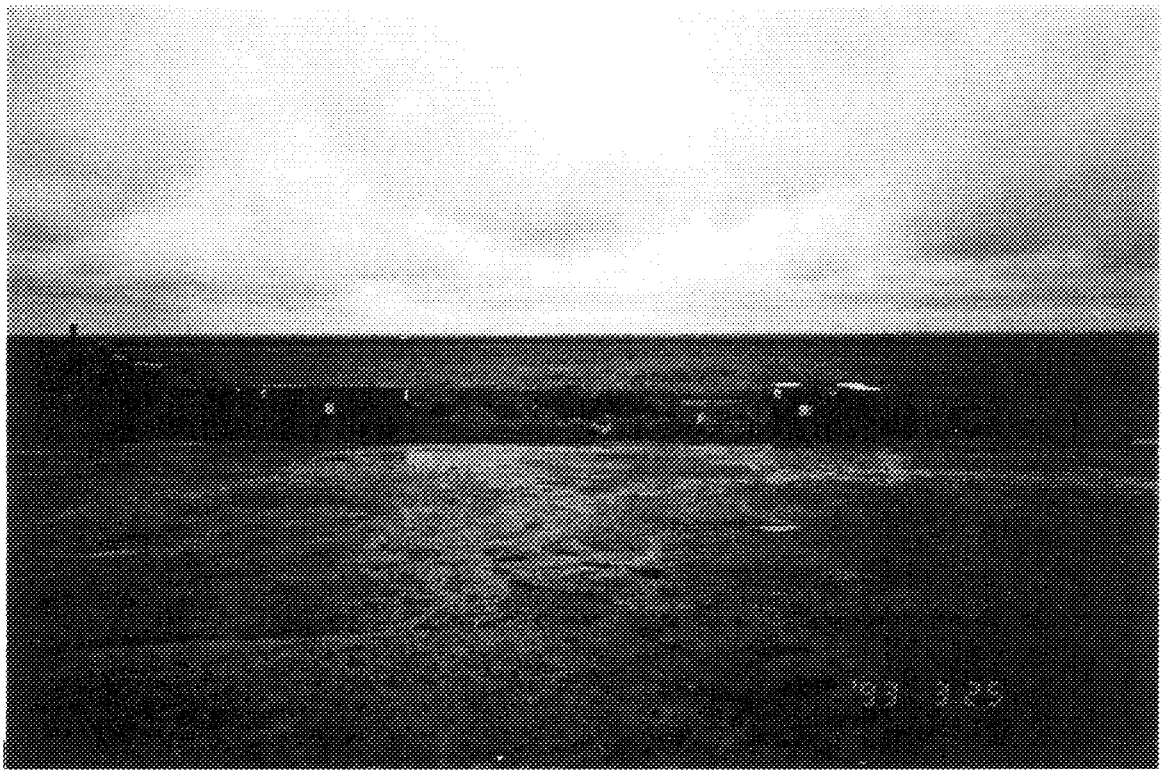
35. U.S. Environmental Protection Agency, Office of Toxic Substances, Graphical Exposure Modeling Systems (G.E.M.S) Database, General Sciences Corporation, 1983 Population Estimates, March 1989.

36. California Department of Fish and Game, Natural Diversity Database, 1991.

APPENDIX B
Photographic Documentation



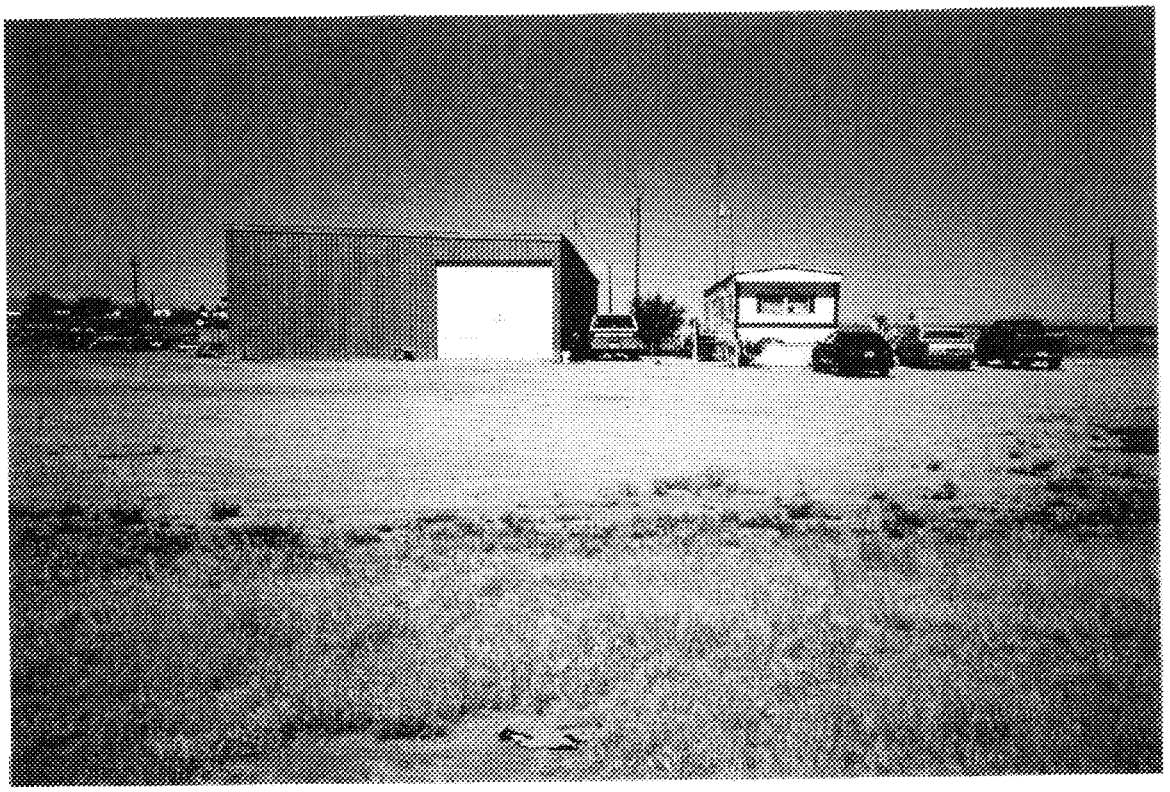
1. Drilling mud storage and mix tanks at the northern leasable parcel (facing northeast).



2. The northern leasable parcel is predominantly exposed soils bordered by grassy fields (facing east).

3. Farm Flite Ag. Service operated from buildings shown in background in the northern leasable parcel (facing north)

4. A trailer park is northwest of the site, directly across Lost Hills Road (facing west).



5. An occupied trailer home adjacent to vacant airplane hangar in the northern leasable parcel (facing west).

6. Historically, the exteriors of airplanes used for pesticide application were rinsed on this concrete apron (facing east).

APPENDIX C

CONTACT LOG

Site: Farm Flite Ag. Service

EPA ID: 983650078

Name	Affiliation	Phone	Date	Information
Kathy Scott	RWQCB Region 5	(209) 445-5116	2/23/93	The agency has no files on Farm Flite Ag. Service (a.k.a. Lost Hills Flying Service) or Keystone Resources (a.k.a. Keystone Metal Co.). Furthermore, the RWQCB branch in Lahontan does not have jurisdiction over Lost Hills or Bakersfield.
Katie Nash	Cal-EPA	(209) 297-3905	2/23/93	I will send request to view files and justification to 1515 Tollhouse Rd., Clovis, CA 93611. Fax (209) 297-3904.
Lydia Von Sydow	Kern County Environmental Health Services Department	(805) 861-3636	2/23/93	I will send request to view files to: 2700 M St., Suite 300, Bakersfield, CA 93301. Fax (805) 861-3429.
Carol Harvey	Kern County Air Pollution Control District	(805) 861-3682	2/24/93	No files for Farm Flite Ag. Service or Lost Hills Flying Service.
Katie Nash	Cal-EPA	(209) 297-3905	2/24/93	An appointment was set up to view files on Tuesday, March 2 between 9 and 9:30 a.m.
Lydia Von Sydow	Kern County Environmental Health Services Department	(805) 861-3636	2/24/93	An appointment was set up to view files on Tuesday, March 2, at 2 p.m.

CONTACT LOG (Cont'd)

Site: Farm Flite Ag. Service

Name	Affiliation	Phone	Date	Information
Receptionist	Kern County Assessor's Office	(805) 861-2311	2/24/93	Located at 1115 Truxton Ave. at Chester in Bakersfield. Pyramid glass building, 2nd floor. Cost is $5 for parcel maps.
Ted Anderson	Kern County Department of Airports	(805) 393-7990	3/4/93	Kern County Department of Airports is the owner and operator for Lost Hills Airport and six other airports in the area. They oversee activities at Lost Hills Airport and maintain files on historic and present lessees there. I will send the pre-confirmation letter to 1401 Skyway Dr., Suite 200, Bakersfield, CA 93308; Fax (805) 393-7994.
Ted Anderson	Kern County Department of Airports	(805) 393-7990	3/16/93	He is willing to conduct the site visit on Thursday, March 25. I should talk to Frank Day, who will accompany me, about finalizing the time.
Frank Day	Kern County Department of Airports	(805) 393-7990	3/17/93	A site visit was set up for Thursday, March 25 at 9:15 a.m. Meet at his office at the Bakersfield Airport. Unibar Drilling Fluids is currently operating on site. The general manager is Tom Jester who can be reached at (805) 797-2479.

CONTACT LOG (Cont'd)

Site: Farm Flite Ag. Service

Name	Affiliation	Phone	Date	Information
Tom Jester	Unibar Drilling Fluids	(805) 797-2479	3/18/93	He will attend the site visit. He is currently operating a mud plant on site. Unibar is sub-leasing the property from Farm Flite Ag. Service, which still owns the building on site. I will send a copy of the site visit confirmation to Unibar, P.O. Box 37, Lost Hills, CA 93249.
Frank Day	Kern County Department of Airports	(805) 393-7990	3/18/93	Marion Goolsby owns the building on site, but currently lives on the coast. No other Farm Flite Ag. Service people remain in the area. He did not have a contact number for Goolsby but gave me the following address where they send bills to: 353 Weymouth St., Cambria, CA 93428.
Frank Day	Kern County Department of Airports	(805) 393-7990	3/24/93	He will not be able to make the site visit. He will provide me with a map prior to the visit and will meet with us at 1 p.m. post-visit to discuss any additional info. He probably knows the most about the site, and he does not know much. They only have a lease file, nothing more. He visited the site on a few occassions.
Frank Day	Kern County Department of Airports	(805) 393-7990	4/5/93	See Contact Report.
Barbara Houghton	Environmental Health Services Department	(805) 861-3636	4/5/93	See Contact Report.

CONTACT LOG (Cont'd)

Site: Farm Flite Ag. Service

Name	Affiliation	Phone	Date	Information
Estella Cortez	Lost Hills Utilities District	(805) 797-2730	4/5/93	See Contact Report.
Operator	Information 805 area code	(805) 555-1212	4/6/93	No listing for a Marion Goolsby in Cambria, Calif.
Phil Nixon	Lost Hills Water District	(805) 633-9022	4/7/93	See Contact Report.
Brian O'Kelly	Kern County Fire Department	(805) 797-2308	4/8/93	See Contact Report.
John Usfery	Kern County Planning Department	(805) 861-2615	4/8/93	See Contact Report.
Peter W. Smith	Kern County Council of Governments	(805) 861-2191	4/8/93	See Contact Report.
Tim Heyne	Department of Fish and Game, Southern District	(209) 222-3761	4/14/93	See Contact Report.
Dennis Williams	California Department of Water Resources	(209) 445-5044	4/14/93	See Contact Report.
Frank Day	Kern County Department of Airports	(805) 393-7990	4/14/93	Residents at the Lost Hills Airport are Jose and Gloria Mora. Exemption 6: Privacy and work number (805) 797-2664. They live in and own a mobile home located near the runway and apron.
Señora Mora	House at Lost Hills Airport	Exemption 6: Privacy	4/14/93	The Mora family, Gloria, Jose and their two children, live in the trailer unit near the runway.

CONTACT LOG (Cont'd)

Site: Farm Flite Ag. Service

Name	Affiliation	Phone	Date	Information
Dennis Williams	California Department of Water Resources	(209) 445-5044	4/22/93	Mr. Williams will send a map showing the locations of three private wells near the site. Groundwater in the vicinity is not used for drinking. The California Aqueduct is not used for drinking within 15 miles downstream of the site. Recommended I call Dee Bankston at the Southern Field Division Maintenance Yard for aqueduct stream flow data at (805) 858-2211.
Dee Bankston	California Department of Water Resources	(805) 858-2211	4/26/93	See Contact Report.
Dennis Williams	California Department of Water Resources	(209) 445-5044	4/28/93	He does not have a destruction date for the well at Lost Hills Airport.
Kathy Scott	RWQCB, Region 5	(209) 445-5116	4/28/93	Verified that Larry Glandon is an employee of the RWQCB, Region 5.
Estella Cortez	Lost Hills Municipal Utilities District	(805) 797-2730	5/4/93	Made corrections to contact report of 4/5/93. She referred me to Howard Way of John Carollo Engineers at (510) 932-1710 for technical information on the source for drinking water in the area.
Howard Way	John Carollo Engineers	(510) 932-1710	5/6/93	See Contact Report.
Tom Haslebacher	Kern County Water Agency	(805) 634-1400	5/4/93	See Contact Report.

CONTACT LOG (Cont'd)

Site: Farm Flite Ag. Service

Name	Affiliation	Phone	Date	Information
Frank Day	Kern County Department of Airports	(805) 393-7990	5/4/93	The runway and concrete apron are not considered part of the northern leasable parcel. The parcel is approximately 150,000 square feet. Submit written request to view files to Ted Anderson.
Dennis Williams	California Department of Water Resources	(209) 445-5044	5/10/93	He does not have documentation on drinking water wells within 4 miles of the site. The log for a well he originally identified as located in Township 27, Range 21, Section 3 does not exist. He has no information on the destruction date for the well shown on the map he sent last week. The wells were probably used by transient cattle herders for watering stock.
John Johnson	John Carollo Engineers	(805) 665-0116	5/13/93	Verified that drinking water for Lost Hills is supplied by wells 13 miles east of town. The water is transported through a 12-inch plastic pipeline to an enclosed reservoir tank 2 miles west of town.

APPENDIX D

~~906 00007~~

CONTACT REPORT

906 00017

AGENCY/AFFILIATION: Kern County		
DEPARTMENT: Airports		
ADDRESS: 1401 Skyway Drive, Suite 200	CITY: Bakersfield	
COUNTY: Kern	STATE: CA	ZIP: 93308

CONTACT(S)	TITLE	PHONE
Frank Day	Manager of Operations and Maintenance	(805) 393-7990

BEI PERSON MAKING CONTACT: Jordie Bornstein JB JB	DATE: 4/5/93
SUBJECT: Historical lease and use information for Lost Hills Airport	
SITE NAME: Farm Flite Ag. Service	EPA ID: CAD 983650078

DISCUSSION:

Kern County Department of Airports is the owner and operator of the Lost Hills Airport.

The runway at the Lost Hills Airport is currently used by eight agricultural pesticide application companies for taking off, landing and loading of their airplanes. In addition, the airport has two leasable parcels, one in the southern portion of the airport and one in the northern portion near the runway. The northern parcel includes an airplane hangar and an underground fuel tank, the southern parcel is 9,000 square feet. Mr. Day was not aware of any dry wells located on either parcel.

Northern parcel

Lost Hills Flying Service, an aerial pesticide applicator, began to lease this area in 1979. In 1980 the owner, DeRoy Simpson, built the airplane hangar that presently occupies the parcel. It is uncertain when Lost Hills Flying Service ceased operations on the parcel; however, Kern County Airports purchased the hangar from Nancy Hood (wife and survivor of Mr. Simpson) in June 1987. From December 1987 to November 1990, Kaweah Crop Dusters operated an aerial pesticide application business on the parcel.

CONTACT REPORT (Cont'd)

AGENCY/AFFILIATION: Kern County		
CONTACT(S)	TITLE	PHONE
Frank Day	Manager of Operations and Maintenance	(805) 393-7990
SITE NAME: Farm Flite Ag. Service		EPA ID: CAD 983650078

DISCUSSION: Cont'd

From May 1991 until the present, the southernmost building has been rented for the storage of aircraft. In addition, one family currently lives on the parcel. The family rents one building on the parcel due to its proximity to Richey Farms, their place of employment. Mr. Day stated that he does not have a record of the date the family began living on the parcel. Mr. Day assumed that the parcel was essentially vacant during any dates for which he does not have records of a lessee.

Southern parcel

In October 1987 Farm Flite Ag. Service owners, Marion Goolsby and John Gillis, brought the trailers on site and constructed the building which both are presently on the parcel. In December 1987, James Payne and Roland Johnson took over the business and lease. However, the business and lease was again transferred back to Mr. Goolsby and Mr. Gillis at some point prior to 1991. In 1991, Unibar Drilling Fluids subleased the parcel from Farm Flite Ag. Service. Farm Flite Ag. Service currently owns the building and trailers on the parcel and is named in the lease as lessee. SE

Mr. Day has documentation that in July 1983, Farm Flite Ag. Service entered into a lease agreement with Kern County Airports; however, Mr. Day is uncertain whether this lease was for the northern or southern parcel.

CONTACT CONCURRENCE: Frank X. Day DATE: 4-13-93

CONTACT REPORT

AGENCY/AFFILIATION: Kern County Resource Management Agency		
DEPARTMENT: Environmental Health Services Department (EHSD)		
ADDRESS: 2700 M Street	CITY: Bakersfield	
COUNTY: Kern	STATE: CA	ZIP: 93301

CONTACT(S)	TITLE	PHONE
Barbara Houghton	Hazardous Materials Specialist	(805) 861-3636

BEI PERSON MAKING CONTACT: Jordie Bornstein JB	DATE: 4/5/93
SUBJECT: EHSD involvement with activities at Lost Hills Airport	
SITE NAME: Farm Flite Ag. Service	EPA ID: CAD 983650078

DISCUSSION:

From approximately 1991 until 1992, Ms. Houghton conducted routine inspections of Lost Hills Flying Service. The company was a pesticide application service which operated out of an area in the northern portion of the Lost Hills Airport near the runway. Although the company went out of business in 1990, the EHSD continues to inspect the site to ensure that their underground storage tank is maintained. The business was not in operation during any of the inspections which Ms. Houghton conducted.

Farm Flite Ag. Service was a distinctly separate pesticide application service which operated out of an area in the southern portion of the Lost Hills Airport. To the best of her knowledge, Ms. Houghton stated that the EHSD has not been involved with this operation in any capacity as no underground storage tanks are known to exist on the site.

CONTACT CONCURRENCE: _____ DATE: _____

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906 00032

CONTACT REPORT

AGENCY/AFFILIATION: Lost Hills Utilities District		
DEPARTMENT:		
ADDRESS: P.O. Box 246	CITY: Lost Hills	
COUNTY: Kern	STATE: CA	ZIP: 93249
CONTACT(S)	TITLE	PHONE
Estella Cortez	Secretary/Treasurer	(805) 797-2730
BEI PERSON MAKING CONTACT: Jordie Bornstein HB		DATE: 4/5/93
SUBJECT: Water supply for Lost Hills		
SITE NAME: Farm Flite Ag. Service	EPA ID: CAD 983650078	

DISCUSSION:
The Lost Hills Utilities District supplies drinking water to approximately 1,000 people (200 connections) in the Lost Hills area.

CONTACT CONCURRENCE: Estella Cortez DATE: 5-21-93

CONTACT REPORT

AGENCY/AFFILIATION: Lost Hills Water District		
DEPARTMENT:		
ADDRESS: 3008 Sillect Avenue	CITY: Bakersfield	
COUNTY: Kern	STATE: CA	ZIP: 93308
CONTACT(S)	TITLE	PHONE
Phil Nixon	Manager	(805) 633-9022
BEI PERSON MAKING CONTACT: Jordie Bornstein JB JJ		DATE: 4/7/93
SUBJECT: Information on the California Aqueduct		
SITE NAME: Farm Flite Ag. Service	EPA ID: CAD 983650078	

DISCUSSION:

The California Aqueduct is an open-air, concrete-lined canal which runs through Lost Hills on its way from Northern to Southern California. The aqueduct is fenced on both sides and thus, is not accessible to the public. Mr. Nixon was aware of an historical public access area for the aqueduct. To the best of his knowledge, Mr. Nixon thought that the access area was located near where the aqueduct intersects Lost Hills Road; however, he was not certain of the location or whether the public access area currently exists. The Department of Water Resources may have more information on issues of public access and flow rates for the aqueduct.

Within the Lost Hills Water District, the water in the canal is used for agricultural purposes only. Mr. Nixon thought that aqueduct water was not used for drinking purposes at all until it reached Southern California.

CONTACT CONCURRENCE: _____ DATE: _____

CONTACT REPORT

AGENCY/AFFILIATION: Kern County Fire Department		
DEPARTMENT:		
ADDRESS: P.O. Box 155	CITY: Lost Hills	
COUNTY: Kern	STATE: CA	ZIP: 93249
CONTACT(S)	TITLE	PHONE
Brian O'Kelly	Captain	(805) 797-2308
BEI PERSON MAKING CONTACT: Jordie Bornstein		DATE: 4/8/93
SUBJECT: Fire Department involvement in activities at Lost Hills Airport		
SITE NAME: Farm Flite Ag. Service	EPA ID: CAD 983650078	

DISCUSSION:

The Kern County Fire Department conducts routine fire inspections of the various buildings at the Lost Hills Airport. The inspections primarily consist of a cursory check for fire extinguishers and any apparent hazards. The fire department keeps inspection reports on file for approximately 2 years, then destroys them.

Mr. O'Kelly checked their files for the Lost Hills Airport and reported that the file contained inspection reports from 1989 and 1990. In 1989, the inspection report indicated that Farm Flite Ag. Service was operating out of the newer hangar located in the southern portion of the airport. In 1990, an inspection report documented that Farm Flite Ag. Service was no longer in operation and that the buildings were vacant. An additional inspection report from August 1990 indicated that Kaweah Crop Dusters was operating out of the buildings near the runway in the northern portion of the airport.

Mr. O'Kelly personally conducted a number of the fire department inspections and stated that, as far as he knew, no major hazards were reported; he added that the businesses appeared to be operating legitimately and in accordance with fire regulations.

CONTACT CONCURRENCE: _____ DATE: _____

CONTACT REPORT

AGENCY/AFFILIATION: Kern County Planning Department		
DEPARTMENT: Engineering and Survey Services, Flood Plain Management		
ADDRESS: 2700 M Street, Suite 100	CITY: Bakersfield	
COUNTY: Kern	STATE: CA	ZIP: 93301
CONTACT(S)	TITLE	PHONE
John Usfery	Engineer	(805) 861-2615
BEI PERSON MAKING CONTACT: Jordie Bornstein		DATE: 4/8/93
SUBJECT: Flood zone information for Lost Hills Airport		
SITE NAME: Farm Flite Ag. Service	EPA ID: CAD 983650078	

DISCUSSION:

According to Mr. Usfery, the entire Lost Hills Airport is located in Flood Zone C, which designates an area with a flooding frequency greater than 500 years. The information was taken from FEMA map for Community 060075, Panel 0375 B. The effective date of the map is September 29, 1986.

CONTACT CONCURRENCE: _____ DATE: _____

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CONTACT REPORT 906 00016

AGENCY/AFFILIATION: Kern County		
DEPARTMENT: Council of Governments		
ADDRESS: 1401 19th Street, Suite 200	CITY: Bakersfield	
COUNTY: Kern	STATE: CA	ZIP: 93301
CONTACT(S)	TITLE	PHONE
Peter W. Smith	Senior Planner, Data Center Manager	(805) 861-2191
BEI PERSON MAKING CONTACT: Jordie Bornstein JB JB		DATE: 4/8/93
SUBJECT: Population data for Lost Hills area		
SITE NAME: Farm Flite Ag. Service	EPA ID: CAD 983650078	

DISCUSSION:

According to Mr. Smith, the urbanized area of Lost Hills reported 1,212 people in the 1990 census. In addition, the number of people per occupied housing unit in the area is 5.7 while the number of persons per family is 5.04. This information was taken from Summary Tape File (STF) 1A.

CONTACT CONCURRENCE: Peter W Smith DATE: 4-15-93

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906 00020

CONTACT REPORT

AGENCY/AFFILIATION: Department of Fish and Game		
DEPARTMENT:		
ADDRESS: 1234 East Shaw	CITY: Fresno	
COUNTY: Stanislaus	STATE: CA	ZIP: 93710

CONTACT(S)	TITLE	PHONE
Tim ~~Hine~~ Heyne	Associate Biologist (Marine/Fisheries)	(209) 222-3761

BEI PERSON MAKING CONTACT: Jordie Bornstein JB JB	DATE: 4/14/93
SUBJECT: Information on surface water bodies and endangered species in the vicinity of Lost Hills	
SITE NAME: Farm Flite Ag. Service	EPA ID: CAD 983650078

DISCUSSION:

Although the California Aqueduct is fenced and is not accessible to the public, Mr. ~~Hine~~ Heyne is aware that instances of illegal fishing have occurred.

The Kern River Channel periodically contains water; however, Mr. ~~Hine~~ Heyne thought that it was used as a canal for agricultural interests ~~only~~. He stated that there has not been any water in the canal for the past 5 or 6 years. This should be confirmed by the water agencies. of flood basin it is likely

Mr. ~~Hine~~ Heyne stated that he will attempt to locate a game warden who is more familiar with the Lost Hills area in order to get a more accurate picture of recreational fishing on both of these water bodies. He also suggested I contact the Department of Water Resources for stream flow data and information on water use.

Two endangered species, the blunt nosed leopard lizard and Tipton kangaroo rat are listed in the Natural Diversity Database as being within 1 mile of the site. Due to the site characterization as a grassy field surrounded by agricultural lands, Mr. ~~Hine~~ Heyne thought it was reasonable to assume that these species might actually be found on the site itself.

Mr. Heyne recomends that Bechtel (Jordie Bornstein) contact the Environmental Services Division of CDFG at (209) 445-6152 to discuss the project with that ~~Branch~~ Division of ~~one~~ CDFG! Jeff Single!

CONTACT CONCURRENCE: [signature] DATE: 4/20/93

CONTACT REPORT

AGENCY/AFFILIATION: California Department of Water Resources (DWR)		
DEPARTMENT: Groundwater Data Unit		
ADDRESS: 3374 East Shields Ave.	CITY: Fresno	
COUNTY: Fresno	STATE: CA	ZIP: 93726-6990

CONTACT(S)	TITLE	PHONE
Dennis Williams	Chief	(209) 445-5038

BEI PERSON MAKING CONTACT: Jordie Bornstein JB 4/23	DATE: 4/14/93
SUBJECT: Groundwater and surface water information for Lost Hills	
SITE NAME: Farm Flite Ag. Service	EPA ID: CAD 983650078

DISCUSSION:

The Kern River Channel does not normally have water in it except after an exceedingly wet winter. Due to the channel's intermittent nature, Mr. Williams estimated that there would be a limited number of fish being caught along the channel.

Historically, wells in the area were drilled to 20 or 30 feet and were used for the watering of stock by sheep herders. However, most of these wells were closed down with the construction of the California Aqueduct which provided sufficient water to bring agriculture into the area. Mr. Williams stated that there are few groundwater wells remaining in the area. He will check the DWR files and see if he can find any historic well logs for the Lost Hills Airport located at Township 26 South, Range 21 East, Section 35.

The DWR has a maintenance yard for the California Aqueduct located in Lost Hills. Mr. Williams thought that the San Joaquin Field Division, Engineering Department, might have stream flow data for the aqueduct.

CONTACT CONCURRENCE: _____ DATE: _____

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906 00031

CONTACT REPORT

AGENCY/AFFILIATION: California Department of Water Resources			
DEPARTMENT: San Joaquin Field Division			
ADDRESS: 4201 Sabodan Street		CITY: Mettler	
COUNTY: Kern		STATE: CA	ZIP: 93313
CONTACT(S)	TITLE		PHONE
Dee Bankston	Water Services Supervisor		(805) 858-2211
BEI PERSON MAKING CONTACT: Jordie Bornstein JB JB			DATE: 4/26/93
SUBJECT: Stream flow data for the California Aqueduct near Lost Hills			
SITE NAME: Farm Flite Ag. Service		EPA ID: CAD 983650078	

DISCUSSION:

Flow rates for the California Aqueduct vary from a maximum of 5,000 cubic-feet per second to a minimum of 400 cubic-feet per second. Mr. Bankston estimated that, on average, the aqueduct pumps 2.5 million acre-feet of water per year - a flow rate equivalent to 3,000 cubic-feet per second.

CONTACT CONCURRENCE: Dee Bankston DATE: 5-10-93

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906 00033

CONTACT REPORT

AGENCY/AFFILIATION: John Carollo Engineers		
DEPARTMENT:		
ADDRESS: 450 North Wiget Lane	CITY: Walnut Creek	
COUNTY: Contra Costa	STATE: CA	ZIP: 94598
CONTACT(S)	TITLE	PHONE
Howard Way	Partner	(510) 932-1710
BEI PERSON MAKING CONTACT: Jordie Bornstein JB		DATE: 5/6/93
SUBJECT: Information on drinking water in Lost Hills		
SITE NAME: Farm Flite Ag. Service	EPA ID: CAD 983650078	

DISCUSSION:

Mr. Way explained that the drinking water in Lost Hills is supplied by wells. However, the wells are located 13 miles east of the town of Lost Hills and the water is transported through a pipeline. Mr. Way stated that water being drawn from areas further west of these wells is generally not suitable for drinking purposes. Mr. Way referred me to John Johnson, in their Bakersfield office at (805) 665-0116, for more information.

CONTACT CONCURRENCE: H. Howard Way DATE: 5/25/93

CONTACT REPORT

AGENCY/AFFILIATION: Kern County Water Agency		
DEPARTMENT:		
ADDRESS: P.O. Box 58	CITY: Bakersfield	
COUNTY: Kern	STATE: CA	ZIP: 93302-0058
CONTACT(S)	TITLE	PHONE
Tom Hasleybacher	Geologist	(805) 634-1400
BEI PERSON MAKING CONTACT: Jordie Bornstein MB JB		DATE: 5/4/93
SUBJECT: Hydrogeological information for the vicinity of Lost Hills		
SITE NAME: Farm Flite Ag. Service	EPA ID: CAD 983650078	

DISCUSSION: Groundwater in the region occurs in two aquifers which are frequently referred to as the "confined" and "unconfined" aquifers. However, Mr. Hasleybacher stated that he did not like to refer to the "unconfined" aquifer as such since it is actually locally and regionally confined. He added that the regional confinement occurs because of the variability in the unconsolidated alluvial sediments which underlie the entire area. These sediments are a part of the Tulare formation and are derived from the marine sediments found in the Coast Range to the west.

Movement of groundwater beneath the site is predominantly to the southwest. Depth to groundwater in Section 36, located immediately east of the site, is 50 feet below ground surface. Mr. Hasleybacher estimated that the depth to groundwater at the site would probably be slightly greater than 50 feet due to the increased elevation at the site. He added that groundwater in the vicinity of Lost Hills is not used for drinking or irrigation purposes.

CONTACT CONCURRENCE: _____ DATE: _____

APPENDIX E

SITE RECONNAISSANCE INTERVIEW AND OBSERVATIONS REPORT

Bechtel Environmental, Inc.
P.O. Box 193965
San Francisco, CA 94119-3965

OBSERVATIONS MADE BY: Jordie Bornstein and Ed Hou

DATE: March 25,1993
(re-visit May 19, 1993)

FACILITY REPRESENTATIVE(S) and TITLE(S):

Tom Jester - Manager, Unibar Energy Services, Inc. (March 25, 1993)

Tom Nielsen - Renter, airplane hangar in northern leasable parcel (May 19, 1993)

SITE: Farm Flite Ag. Service

EPA ID: CAD 983650078

A site reconnaissance visit was conducted at the southern leasable parcel of Farm Flite Ag. Service on March 25, 1993. The weather was rainy and the temperature was approximately 65°F. The Bechtel Environmental, Inc. (BEI) team, Jordie Bornstein and Ed Hou, conducted the site reconnaissance with Tom Jester at 10:30 a.m. to gather information on the site location and size, site history, processes used, and any hazardous waste generated, treated, stored or disposed of on site. The reconnaissance included a site tour of only the southern parcel during which photographs were taken.

A second site visit was conducted on May 19, 1993, in order to tour the northern leasable parcel since the EPA had clarified that the site to be investigated included the entire Lost Hills Airport. Tom Nielsen was present for the 11 a.m. tour during which photographs were taken.

The following information was obtained during the site reconnaissance:

The site covers approximately 381 acres in a rural area and is at Lost Hills Airport, approximately 60 miles northwest of Bakersfield, Calif. The Lost Hills Airport is a non-commercial airport overseen and owned by the Kern County Department of Airports. The site is bordered by Lost Hills Road on the west, State Highway 46 on the south, and agricultural lands to the north and east. Lost Hills Park and a fire station are adjacent to the site in the southwest corner. There is a trailer park, containing approximately 100 trailers, directly across Lost Hills Road from the site. Lost Hills Airport has two entrances off Lost Hills Road, which lead to two separate leasable areas of the site, a southern leasable parcel and a northern leasable parcel. In addition, the site includes vacant grassy lands between the leasable parcels, a 3,000-foot paved runway, and a concrete apron. The site is completely fenced and is predominantly covered by grassy fields except for buildings, runways, or roads.

- **Southern Parcel**

The Southern leasable parcel covers approximately 9,000 square feet and is currently occupied by Unibar Energy Services (Unibar). Unibar has sublet the parcel from Farm Flite Ag. Services (Farm Flite) since June of 1991. Unibar is owned by Anchor Drilling Fluids, a Norwegian-based firm. Prior to moving on site in 1991, Unibar had office space in Bakersfield.

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The yard area east of the Unibar office is occupied by storage and mixing tanks of varying sizes and contents. Five 22,000-gallon water storage tanks, and seven 11,000 - 22,000 gallon tanks, all of which are aboveground. Also in this area are the mud-storage tanks and mud-mixing tanks. Bactericide, antifoam, bentonite gel, and barite are stored on wooden pallets throughout the entire yard area and in the aluminum storage sheds. Unibar keeps approximately four- to five-thousand 100-pound sacks of bentonite and five- to six-thousand 100-pound sacks of barite on site at all times.

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Currently, the northern parcel contains a northern and a southern airplane hangar, a trailer, and a 10,000-gallon underground storage tank. The northern hangar is not currently occupied, however, Tom Nielsen has been renting the southern hangar since May 1991 to store airplanes. In addition, Mr. Nielsen uses the runway for takeoff and landing. The area between the two hangars is partially fenced, contains miscellaneous piping supplies, and is posted with warning signs of pesticide container storage. The trailer is currently occupied by one family. The underground tank was previously used for storage of aviation fuel; however, Mr. Nielsen stated he personally used up the contents in 1992 (approximately $2,000 worth of fuel) to release himself from liability and responsibility for maintaining the tank. Ground cover in the immediate vicinity of the hangars and trailers is exposed soil. The land beyond the exposed soil is predominantly flat and covered by low grasses.

Mr. Nielsen noted the only problem he has had with runway use is unauthorized planes landing for what he called "questionable purposes." He suspects in most instances, the cargo on board such small, often unmarked and/or stolen planes, is likely illegal substances. Mr. Nielsen reports these incidences to both the local authorities and the Department of Airports, which identified the planes as stolen on occasion. So far, no one has attempted to intervene. Mr. Nielsen was not aware of the existence of any wells and did not know about the historical uses of the northern parcel prior to 1991.

Surface water runoff on site did not seem to flow anywhere in particular. There are no constructed drainage systems. No evidence of a leach field, stressed vegetation, or wells could be seen during the site tour.

Mr. Nielsen said there is an over-population of jack rabbits and other small rabbits on site. In addition, there were many stray dogs and cats that roam freely around the site.

The Lost Hills Fire Department and the Kern County Airports conduct occasional inspections of the airport facilities.

TRANSMITTAL LIST

Site: Farm Flite Ag. Service

Ted Anderson/Frank Day
County of Kern
Department of Airports
1401 Skyway Blvd., Suite 200
Bakersfield, CA 93308

JUL 27 1993

Barbara Houghton
County of Kern
Resource Management Agency
Environmental Health Services Department
2700 "M" St., Suite 300
Bakersfield, CA 93301

Marion Goolsby
Exemption 6: Privacy

Kathy Scott
California Environmental Protection Agency
California Regional Water Quality Control Board, Central Valley Region
Fresno Branch Office
3614 East Ashlan Ave.
Fresno, CA 93726

Katie Nash
California Environmental Protection Agency
Department of Toxic Substances Control, Region 1
1515 Tollhouse Rd.
Clovis, CA 93611

Bechtel

50 Beale Street
San Francisco, CA 94105-1895
Mailing address: P.O. Box 193965
San Francisco, CA 94119-3965

REFERENCES
for

Preliminary Assessment

Site: Farm Flite Ag. Service
Lost Hills Airport
Lost Hills, CA 93249

Site EPA ID Number: CAD 983650078

Work Assignment Number: 60-15-9J00, ARCSWEST Program

Submitted to: Michael Bellot, EPA Region IX

Thru: Rachel Loftin

Date: June 14, 1993

Prepared by: Jordie Bornstein

Review and Concurrence: Catherine C. Walton, BEI ARCS

Bechtel Environmental, Inc.

REFERENCE LIST

Site: Farm Flite Ag. Service

1. U.S. Environmental Protection Agency, Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS), February 1, 1993.

2. Baldwin, William D., California Regional Water Quality Control Board, Region 5, Letter to L. Dale Mills (with attached Memorandum Inspection Report), Department of Public Works, July 31,1980.

3. Department of Health Services, Report of Inspection of Farm Flite Ag. Service (with attached Active Site Inspection Checklist) completed by Debbie Small, January 20, 1983.

4. Bornstein, Jordie, Bechtel Environmental, Inc., Site Reconnaissance Interview and Observations Report, March 25, 1993.

5. U.S. Geologic Survey, Lost Hills Quadrangle, California-Kern Co., 7.5-Minute Series (topographic), Photorevised 1973.

6. Kern County Public Works Department and County Surveyor, Airport Layout Plan, Lost Hills Airport, October 1974.

7. Kern County Environmental Health Services Department, Permit to Operate Underground Hazardous Storage Facility (with attached maps showing location) issued to Lost Hills Flying Service, Issue Date: September 23, 1991, Expiration Date: September 23, 1996.

8. Anderson, Ted, County of Kern, Department of Airports, Telephone conversation recorded on Contact Log by Jordie Bornstein, Bechtel Environmental, Inc., March 4, 1993.

9. Day, Frank, County of Kern, Department of Airports, Telephone conversation recorded on Contact Report by Jordie Bornstein, Bechtel Environmental, Inc., April 5, 1993.

10. California Department of Water Resources, Undated map showing water well locations in the vicinity of the Lost Hills Airport received from Dennis Williams, April 26, 1993.

11. Williams, Dennis, California Department of Water Resources, Telephone conversation recorded on Contact Log by Jordie Bornstein, Bechtel Environmental, Inc., May 10, 1993.

12. Department of Health Services, Abandoned Site Program Drive-By Record (with attached Field Photograph Log Sheet) completed by Astrid Johnson, June 29, 1988.

13. U.S. Environmental Protection Agency, Resource Conservation and Recovery Act Notifiers List, Region IX Database, January 19, 1993.

REFERENCE LIST (Cont'd)

Site: Farm Flite Ag. Service

14. Department of Health Services, Abandoned Site Project Final Disposition (with attached Site Information and Prioritization Criteria) completed by Debbie Small, February 7, 1983.

15. Galindo, Lawrence, County of Kern, Department of Airports, Memorandum to Richard Casagrande, August 27, 1987.

16. Kern County Health Department, Application for Permit to Operate Underground Hazardous Substances Storage Facility forms, June 1, 1987 and February 4, 1988.

17. Houghton, Barbara, Kern County Resource Management Agency, Environmental Health Services Department (EHSD), Telephone conversation recorded on Contact Report by Jordie Bornstein, Bechtel Environmental, Inc., April 5, 1993.

18. Houghton, Barbara, EHSD, Leter to Frank Day, County of Kern, Department of Airports (with attached Hazardous Substance Storage Facility Inspection Report), April 3, 1992.

19. Houghton, Barbara, EHSD, Letter to Frank Day, County of Kern, Department of Airports (with attached Hazardous Substance Storage Facility Inspection Report and Phase I Vapor Recovery Inspection Form) February 22, 1991.

20. Kern County Department of Agriculture, Pesticide Use Monitoring Inspection Report completed by David J. Moore, July 12, 1990.

21. Kern County Department of Agriculture, Notice of Violation No. 004866, July 23, 1990.

22. Kern County Department of Agriculture, Pesticide Use Monitoring Inspection Report completed by Richard White, August 2, 1990.

23. O'Kelly, Brian, Kern County Fire Department, Telephone conversation recorded on Contact Report by Jordie Bornstein, Bechtel Environmental, Inc., April 8, 1993.

24. Page, R.W., U.S. Geological Survey Professional Paper 1401-C, Geology of the Fresh Ground-Water Basin of the Central Valley, California, with Texture Maps and Sections, Regional Aquifer-System Analysis, 1986.

25. Haslebacher, Tom, Kern County Water Agency, Telephone conversation recorded on Contact Report by Jordie Bornstein, Bechtel Environmental, Inc., May 4, 1993.

26. Cortez, Estella, Lost Hills Utilities District, Telephone conversation recorded on Contact Report by Jordie Bornstein, Bechtel Environmental, Inc., April 5, 1993.

27. Way, Howard, John Carollo Engineers, Telephone conversation recorded on Contact Report by Jordie Bornstein, Bechtel Environmental, Inc., May 6, 1993.

REFERENCE LIST (Cont'd)

Site: Farm Flite Ag. Service

28. Nixon, Phil, Lost Hills Water District, Telephone conversation recorded on Contact Report by Jordie Bornstein, Bechtel Environmental, Inc., April 7, 1993.

29. Bankston, Dee, California Department of Water Resources, Telephone conversation recorded on Contact Report by Jordie Bornstein, Bechtel Environmental, Inc., April 26, 1993.

30. Heyne, Tim, California Department of Fish and Game, Telephone conversation recorded on Contact Report by Jordie Bornstein, Bechtel Environmental, Inc., April 14, 1993.

31. Williams, Dennis, California Department of Water Resources, Telephone conversation recorded on Contact Report by Jordie Bornstein, Bechtel Environmental, Inc., April 14, 1993.

32. Usfery, John, Kern County Planning Department, Telephone conversation recorded on Contact Report by Jordie Bornstein, Bechtel Environmental, Inc., April 8, 1993.

33. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service, Atlas 2, Volume XI, Isopluvials of 2-year, 24-hour precipitation for Southern Half of California in Tenths of an Inch.

34. Mora, Senora, Telephone conversation recorded on Contact Log by Jordie Bornstein, Bechtel Environmental, Inc., April 14, 1993.

35. U.S. Environmental Protection Agency, Office of Toxic Substances, Graphical Exposure Modeling Systems (G.E.M.S) Database, General Sciences Corporation, 1983 Population Estimates, March 1989.

36. California Department of Fish and Game, Natural Diversity Database, 1991.

EPA REGION IX - CERCLIS SITES
LIST-8 REPORT FOR REGION IX
SORTED BY SITENAME

EPA ID NO.	SITE NAME STREET CITY, COUNTY CODE AND NAME	STATE ZIP CONG DIST.	EVENT QUALIF	OP UN	EVENT TYPE	ACTUAL START DATE	ACTUAL COMPL DATE	CURRENT EVENT LEAD
CAD981159585	FARALLON ISLANDS MIDDLE OF OCEAN FARALLON ISLANDS	CA CA-99		00	DS1		06/01/81	EPA (FUND)
			L		PA1		11/01/87	EPA (FUND)
			H		PA2		05/01/88	EPA (FUND)
			H		SI1		06/06/91	EPA (FUND)
CAD983580846	FARM AIR FLYING SERVICE 4425 WEST RIEGO AVE. SACRAMENTO	CA 95837						
	067 SACRAMENTO	CA-04		00	DS1		02/18/91	EPA (FUND)
			N		PA1		11/29/91	EPA (FUND)
CAD983650078	FARM FLITE AG SERVICE LOST HILLS AIRPORT LOST HILLS	CA 93249						
	029 KERN	CA-17		00	DS1		10/19/92	EPA (FUND)
CAD980889216	FARMER AIR SERVICE 17500 W HOBSON WAY BLYTHRIVERSIDE	CA CA-25		00	DS1		12/01/88	EPA (FUND)
			N		PA1		08/31/89	EPA (FUND)
			N		SI1		08/31/89	EPA (FUND)
CAD982018970	FARMER BROS. CO 20333 S. NORMANDIE AVE. TORRANCE	CA 90502						
	037 LOS ANGELES	CA-31		00	DS1		07/23/92	EPA (FUND)
			N		PA1		01/04/93	EPA (FUND)
CAD983580911	FARMER'S AG SERVICE 920 TUDOR RD. YUBA SUTTER	CA CA-93		00	DS1		04/02/91	EPA (FUND)
			N		PA1		10/01/92	EPA (FUND)
AZD981688062	FARMERS ARGICULTURAL CHEMICAL COMPANY 501 S. LITCHFIELD RD. GOODYEAR	AZ 85338						
	013 MARICOPA	AZ-03		00	DS1		03/16/90	STATE(FUND)
			H		PA1		09/18/90	STATE(FUND)
			N		SI1		09/03/92	STATE(FUND)

REFERENCE 1

REFERENCE 2

31 July 1980

Mr. L. Dale Mills
Director of Public Works
1600 Norris Road
Bakersfield, CA 93301

PESTICIDE RINSE WATER INSPECTIONS AND INVESTIGATIONS AT KERN COUNTY DEPARTMENT OF AIRPORT'S FACILITIES

Our staff has conducted several inspections and participated in or requested some site-specific investigations of agricultural aircraft pesticide rinse water disposal problems at Kern County Department of Airport's facilities. This letter will summarize our findings and conclusions and request Kern County to take action at specific locations.

Enclosed you will find the appropriate memorandum inspection reports and sample results. Based on this information we request the following actions for each airport.

1. Buttonwillow Airport - Implement Kern County Airport Department's ban on pesticide rinse water disposal and/or compliance with the Board's Pesticide Rinse Water Guidelines (copy attached).

2. Famoso Airfield - same as above.

3. Kern Valley - same as above.

4. Lost Hills - same as above.

5. Meadows Field - same as above.

6. Shafter Airport - Waste discharge requirements pursuant to Section 13260 of the Porter-Cologne Water Quality Control Act.

7. Taft Airport - Implement County ban.

8. Tehachapi Airport - same as above.

9. Wasco Airport - Waste discharge requirements.

SURNAME				

The situations at Shafter and Wasco need discharge requirements because of the heavy aircraft applicator use, the soil and geologic conditions and the amounts of pesticides found in the soil samples taken.

We have previously received a report of waste discharge and a comprehensive technical report (Boyle Engineering, February 1980) for Wasco Airport and will proceed with drafting requirements in the near future. The application, filing fee schedule and instructions for Shafter are enclosed for your use.

If you have any questions on this matter, please contact Larry Glandon of our office.

WILLIAM D. BALDWIN
Supervising Engineer

Enclosures

SJG:lsg

cc: Mr. Steven Schmidt, Director, Kern County Department of Airports
Mr. Vern Reichard, Kern County Health Department

bcc: Ron Van de Pol, Sacramento
Robert G. Wright, Fresno

MEMORANDUM

TO: Lawrence R. Glandon Date: 1 November 1979

FROM: David C. Hollingsworth

SUBJECT: FLYBY INSPECTION OF PESTICIDE RINSE WATER FACILITIES AT LOST HILLS AIRPORT, KERN COUNTY

On 10 October 1979, I inspected pesticide rinse water operations at Lost Hills Airport in Kern County.

The purpose of the inspection was to determine the methods of pesticide rinse water management in view of the Board's recent adoption of pesticide rinse water "Guidelines". Currently, there are no Waste Discharge Requirements on the airport or its operators.

The airport is owned by the County of Kern. Lost Hills Flying Service, the only applicator that uses the airport, operates 3-4 planes. Their address is P. O. Box 287, phone (805) 797-2601. A few transients also occasionally use the airport, but rinse out at some other location. During the inspection I talked with Mr. Bernie Gach, pilot and DeRoy Simpson, owner.

A variety of different pesticides are used at this airport. Rinsing operations are limited to airplane exteriors only, which is conducted approximately once per airplane per day, on a concrete pad. Exterior rinsing operation is located north and adjacent to the southern hanger. There were small areas where pesticide residue was visible on the cement. Final rinse water disposal is to a leach field by underground conduit. Booms and hopper tanks are always rinsed over the target crop.

The empty pesticide container storage area consists of a cotton trailer located north of the northern hanger. All of the containers appeared to have been triple rinsed.

Several aerial photos were taken which will be included with this file.

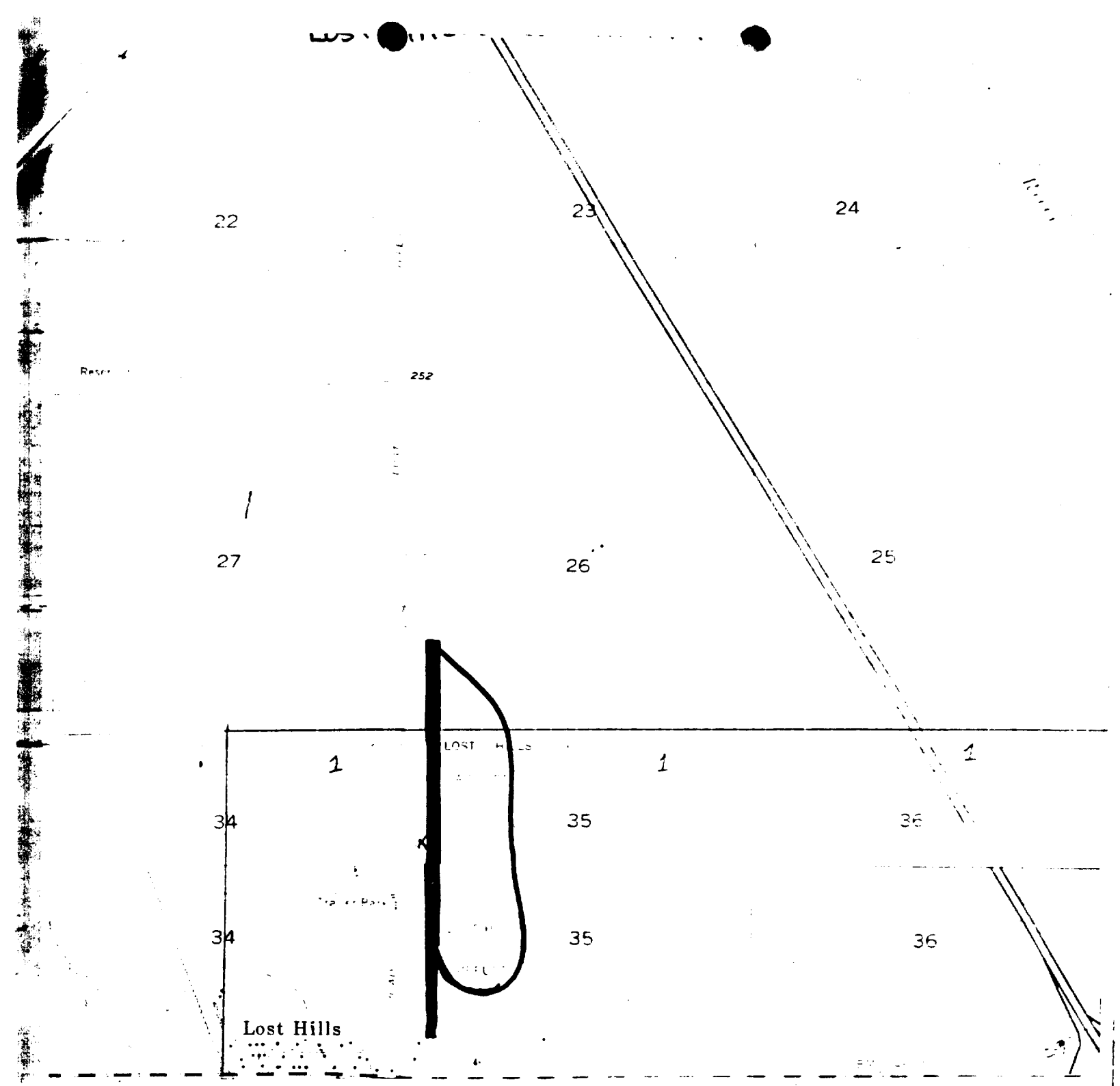
In conclusion, Lost Hills Flying Service appears to be in compliance with the Board's Guidelines. A followup inspection should be made to ascertain if the rinsewater discharged to the leach field is pesticide free wastewater.

David C. Hollingsworth

David C. Hollingsworth
Inspector

DCH/cb

SB



LOST HILLS AIR

3 planes

washdown on concrete pad → seepage pit

cans stored in trailer

Medium - Low priority
2/7/83 WH

REFERENCE 3

Report of Inspection
Farm Hills Ag Service
Lost Hills, California

I Date of Inspection
January 20, 1983

II Purpose
This inspection was conducted to review the firms past and present waste management practices.

III Facility Representative
Warren Ashby, owner - manager

IV State Representative
Debra Small, HWMB, Fresno

V Description of Facility and Waste Streams
This company is an aerial applicator of agricultural chemicals. It has been at this location for approximately 2 years. Lost Hills Flying Service occupied this location for 5 years prior to Farm Hills Ag Service. The companys water source is from Lost Hills water district. There are no wells on the property.

Present disposal practices:

1. Empty pesticide containers are triple rinsed using a closed system. The containers are disposed of at the shelter dump. Approximately 1½ cotton trailers of crushed containers are disposed of yearly. Most containers are returned to the farmer for disposal.

2. The exterior of the planes and other equipment are rinsed off on a wash pad. The rinse water is discharged to two dry wells.

Past disposal practices were the same as the present practices.

VI. Observations

1. The pesticide storage enclosure consisted of a fenced door. Warning signs were posted. No signs of spillage were observed.

2. The storage area for containers consisted of a cotton trailer located north of the

hangar. Approximately twenty 50 gallon drums were stored outside of the cotton trailer. Hazard signs were posted. No stained soil was observed.

VII. Discussion with Management

Mr. Marion Goolsby was present during the entire inspection. Mr. Goolsby exhibited a good understanding of the law. Mr. Goolsby was informed that he would need to obtain an EPH generator number.

VIII. Recommendation

It is recommend that this facility be referred to the Regional Water Quality Control Board for further action concerning the discharge of rinsewater to the two dry wells

SC 9/5/13

Active Site Inspection Checklist

Company Name: Farm Flite Ag Serv Inspector's Name: Debbie Small

Address: Lost Hills Airport, Lost Hills Date of Inspection: [redacted] 1-20-83

Phone: 797-2601, 797-2329 2:00 pm

Company Representative: Marion Goolsby, owner

EPA ID #: not issued.

Background Info:

What does the company do?

aerial application

How long has the company been at this location?

little over 2 years.

What other companies have occupied this location?

Lost Hills Flying Service - Sypo

Manufacturing Info:

What is manufactured and/or formulated?

What hazardous raw materials are used?

What are the processes used?

Waste Disposal Practices:

What type of disposal practices were used in the past?

same as present.

How long were these disposal practices used?

Where is the old disposal site located on the property?

A. If off site disposal in past, where?

What types of waste were disposed of at the old disposal site/or in past? (ask for list)

What are the approximate amounts of waste that were disposed of at the old disposal site?

A. Is this substantiated anywhere?

What are the present disposal practices?
cans rinsed (3x) in field - closed system. - shatter dump.
tanks rinsed in field & applied to field.
extern. rinse → dry well.

What is disposed of presently? (ask for list)

A. What is the composition of the waste stream?

B. Can this be substantiated?

What are the approximate amounts of waste disposed of presently?
1½ gallon trailer of crushed cont. / yr.
most cans returned to farmer for disposal

A. Is this substantiated anywhere?

Water Sources Info:

What is the companies water source?

Lost Hills Water district

Are there any wells on the property?

none

A. Location of wells:

Observations:

wash area - concrete wash rack drains into 2 dry wells.

✓ storage area for pesti. dock, fenced, signs present

✓ rinse storage area: cotton trailer, cans stored whole in trailer until taken to dump - then crushed. Observ ~ 20 50 gal drums outside of cotton trailer, He said did not know what to do with them - event. take to dump. posted, no stained soil evident.

APPENDIX E

SITE RECONNAISSANCE INTERVIEW AND OBSERVATIONS REPORT

Bechtel Environmental, Inc.
P.O. Box 193965
San Francisco, CA 94119-3965

OBSERVATIONS MADE BY: Jordie Bornstein and Ed Hou

DATE: March 25,1993
(re-visit May 19, 1993)

FACILITY REPRESENTATIVE(S) and TITLE(S):

Tom Jester - Manager, Unibar Energy Services, Inc. (March 25, 1993)

Tom Nielsen - Renter, airplane hangar in northern leasable parcel (May 19, 1993)

SITE: Farm Flite Ag. Service

EPA ID: CAD 983650078

A site reconnaissance visit was conducted at the southern leasable parcel of Farm Flite Ag. Service on March 25, 1993. The weather was rainy and the temperature was approximately 65°F. The Bechtel Environmental, Inc. (BEI) team, Jordie Bornstein and Ed Hou, conducted the site reconnaissance with Tom Jester at 10:30 a.m. to gather information on the site location and size, site history, processes used, and any hazardous waste generated, treated, stored or disposed of on site. The reconnaissance included a site tour of only the southern parcel during which photographs were taken.

A second site visit was conducted on May 19, 1993, in order to tour the northern leasable parcel since the EPA had clarified that the site to be investigated included the entire Lost Hills Airport. Tom Nielsen was present for the 11 a.m. tour during which photographs were taken.

The following information was obtained during the site reconnaissance:

The site covers approximately 381 acres in a rural area and is at Lost Hills Airport, approximately 60 miles northwest of Bakersfield, Calif. The Lost Hills Airport is a non-commercial airport overseen and owned by the Kern County Department of Airports. The site is bordered by Lost Hills Road on the west, State Highway 46 on the south, and agricultural lands to the north and east. Lost Hills Park and a fire station are adjacent to the site in the southwest corner. There is a trailer park, containing approximately 100 trailers, directly across Lost Hills Road from the site. Lost Hills Airport has two entrances off Lost Hills Road, which lead to two separate leasable areas of the site, a southern leasable parcel and a northern leasable parcel. In addition, the site includes vacant grassy lands between the leasable parcels, a 3,000-foot paved runway, and a concrete apron. The site is completely fenced and is predominantly covered by grassy fields except for buildings, runways, or roads.

- **Southern Parcel**

The Southern leasable parcel covers approximately 9,000 square feet and is currently occupied by Unibar Energy Services (Unibar). Unibar has sublet the parcel from Farm Flite Ag. Services (Farm Flite) since June of 1991. Unibar is owned by Anchor Drilling Fluids, a Norwegian-based firm. Prior to moving on site in 1991, Unibar had office space in Bakersfield.

Unibar is a drilling mud company that mixes two types of clay-based muds: KCl muds and hydroxyl ethyl cellulose (HEC) polymer muds. The KCl muds are used at variable percentages for drilling in bentonitic formations to stop swelling, while the HEC polymer increases the viscosity of the mud. Antifoam and bactericide are mixed with the water and used to inhibit growth of bacteria. All completion fluids are mixed by Unibar for drilling rigs using an open-air hopper and a mixer. The Unibar mud plant operates from 7 a.m. to 3 p.m., 5 days a week; however, the site is open on a self-serve basis 24-hours a day. The mixing and storage tanks are easily accessible to customer trucks. Trucks can drive onto the property from Lost Hills Road, and then pull up next to the tanks (between the office building and the tanks) to load up. The drillers purchasing the muds are responsible for dumping the fluids as spent wastes when they are done with them. The majority of Unibar's work comes from major oil companies in the area such as Shell, Texaco, and Chevron. Unibar currently employs five people: one truck driver, one engineer, a manager, and two people who mix mud.

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The only permit Unibar has is from the Air Pollution Control Board for operating engines used to mix the chemicals, clays, and water to make mud.

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The northern leasable parcel is a 150,000-square-foot piece of land to the west of the runway and concrete apron and to the east of Lost Hills Road. A paved road leads from a second entrance off Lost Hills Road to a concrete apron, which is approximately 150 feet by 300 feet. The apron is parallel to the runway and the two are connected by a small, paved road.

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Surface water runoff on site did not seem to flow anywhere in particular. There are no constructed drainage systems. No evidence of a leach field, stressed vegetation, or wells could be seen during the site tour.

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Information extracted from:

U.S. Geological Survey, Lost Hills Quandrangle, California-Kern Co., 7.5-Minute Series (topographic), Photorevised 1973.

Information extracted from:

Kern County Public Works Department and County Surveyor, Airport Layout Plan, Lost Hills Airport, October 1974.

RESOURCE MANAGEMENT AGENCY

REFERENCE 7

RANDALL L. ABBOTT
DIRECTOR

DAVID PRICE III
ASSISTANT DIRECTOR

Environmental Health Services Department
STEVE McCALLEY, REHS, DIRECTOR

Air Pollution Control District
WILLIAM J. RODDY, APCO

Planning & Development Services Department
TED JAMES, AICP, DIRECTOR

ENVIRONMENTAL HEALTH SERVICES DEPARTMENT
PERMIT TO OPERATE UNDERGROUND HAZARDOUS STORAGE FACILITY

Permit No.: 450034C **State ID No.:** 14749

Issued to: LOST HILLS FLYING SERVICE **No. of Tanks:** 1

Location: LOST HILLS AIRPORT
LOST HILLS, CA

Owner: DEPARTMENT OF AIRPORTS KERN COUNTY
1401 SKYWAY DRIVE
BAKERSFIELD, CA 93308

Operator: DEPARTMENT OF AIRPORTS KERN COUNTY
1401 SKYWAY DRIVE
BAKERSFIELD, CA 93308

Facility Profile:

Tank No.	Substance Code	Tank Contents	Tank Capacity	Year Installed	Is piping Pressurized?
1	MVF 1	AVIATION GAS	10,000	1980	NO-SUCTION

This permit is granted subject to the conditions and prohibitions listed on the attached summary of conditions/prohibitions

By: Steve McCalley

Steve McCalley

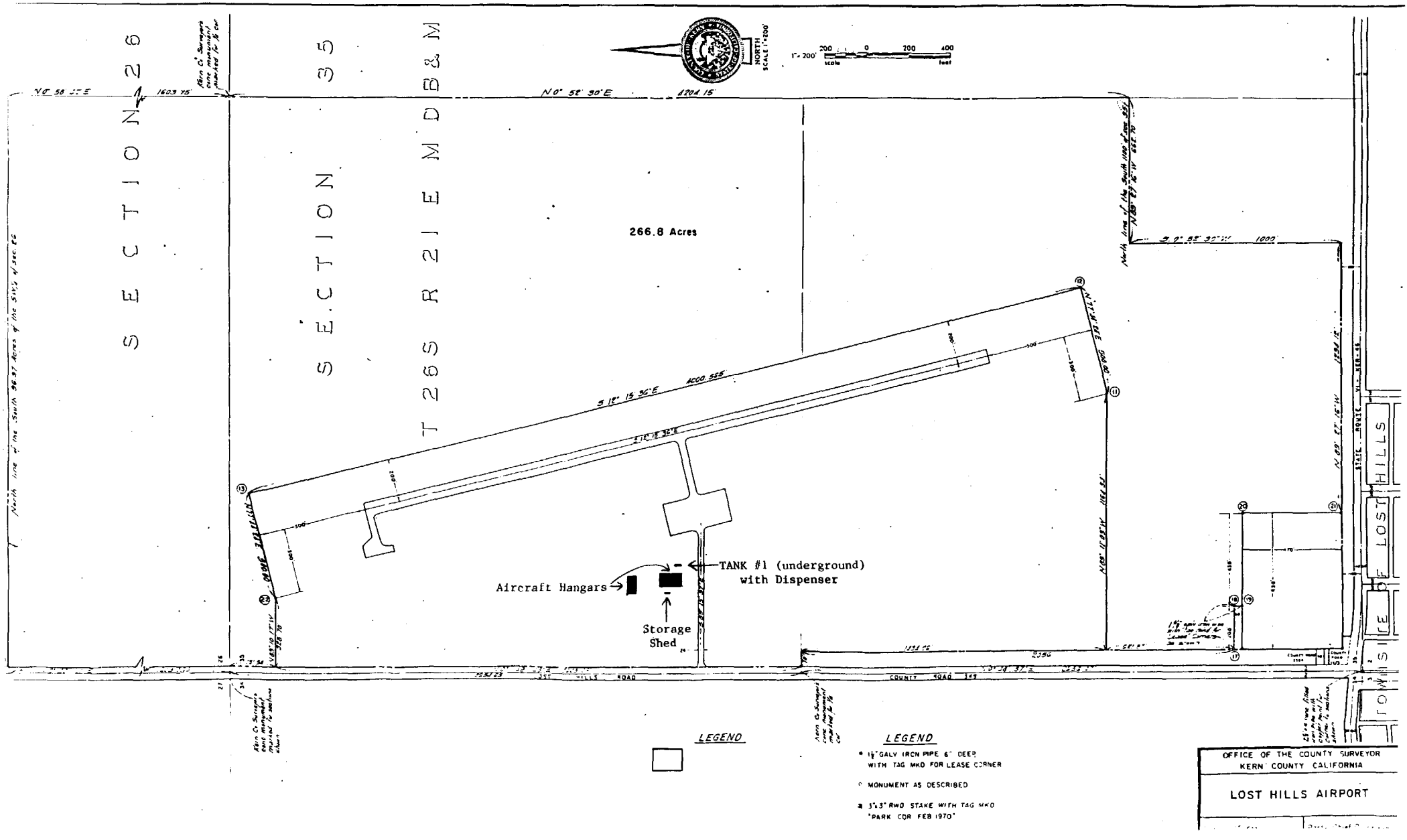
Title: Director, Environmental Health Services Department

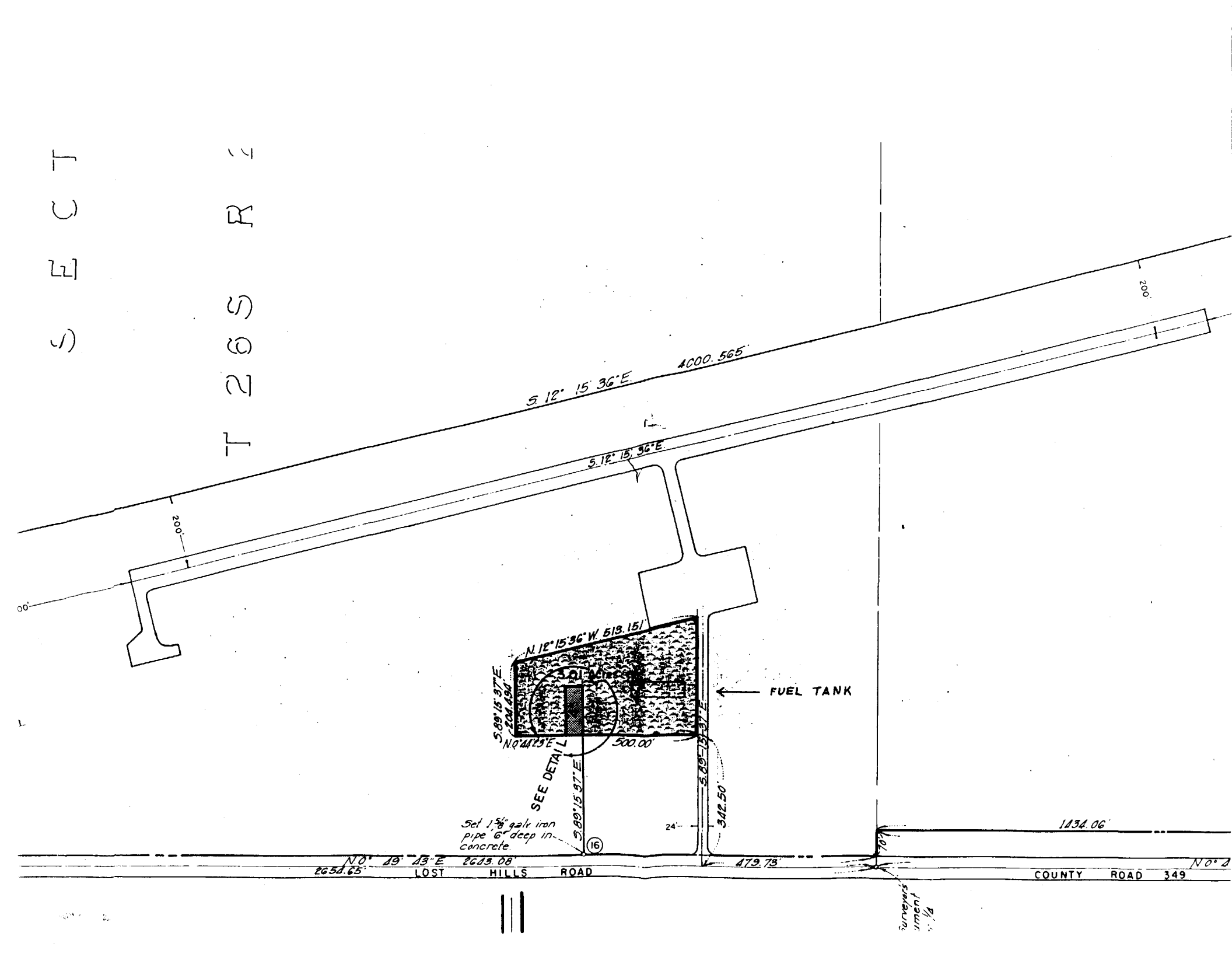
Issue Date: September 23, 1991

Expiration Date: September 23, 1996

-- POST ON PREMISES --
NONTRANSFERABLE

2700 "M" STREET, SUITE 300 BAKERSFIELD, CALIFORNIA 93301 (805) 861-3636
FAX: (805) 861-3429


SECTION 26
SECTION 35
T 26S R 21E MDB&M
266.8 Acres
NORTH
SCALE 1"=200'
1" = 200'
200 0 200 400
scale feet
N0° 52' 30"E 4204.15
N0° 58' 15"E 1603.75
S 12° 15' 30"E 4000.56'
N 12° 15' 30"W 500.00'
S 0° 55' 30"W 1000'
Aircraft Hangars
TANK #1 (underground)
with Dispenser
Storage Shed
LOST HILLS ROAD
COUNTY ROAD 349
STATE ROUTE
LOST HILLS
LEGEND
LEGEND
1½" GALV IRON PIPE 6' DEEP WITH TAG MKD FOR LEASE CORNER
MONUMENT AS DESCRIBED
3"x3" RWD STAKE WITH TAG MKD "PARK COR FEB 1970"
OFFICE OF THE COUNTY SURVEYOR
KERN COUNTY CALIFORNIA
LOST HILLS AIRPORT


S 12° 15' 36" E 4000.565'
S 12° 15' 36" E
200'
200'
N 12° 15' 36" W 513.151'
S 89° 15' 37" E 204.454'
3.01 Acres
FUEL TANK
N 0° 44' 23" E 500.00'
S 89° 15' 37" E 342.50'
SEE DETAIL
Set 1 5/8" galv iron pipe 6" deep in concrete
16
24'
1034.06'
70'
N 0° 29' 43" E 2609.08'
2654.65'
479.78'
LOST HILLS ROAD
COUNTY ROAD 349
N 0° 2
Survey line

CONTACT LOG (Cont'd)

Site: Farm Flite Ag. Service

Name	Affiliation	Phone	Date	Information
Receptionist	Kern County Assessor's Office	(805) 861-2311	2/24/93	Located at 1115 Truxton Ave. at Chester in Bakersfield. Pyramid glass building, 2nd floor. Cost is $5 for parcel maps.
Ted Anderson	Kern County Department of Airports	(805) 393-7990	3/4/93	Kern County Department of Airports is the owner and operator for Lost Hills Airport and six other airports in the area. They oversee activities at Lost Hills Airport and maintain files on historic and present lessees there. I will send the pre-confirmation letter to 1401 Skyway Dr., Suite 200, Bakersfield, CA 93308; Fax (805) 393-7994.
Ted Anderson	Kern County Department of Airports	(805) 393-7990	3/16/93	He is willing to conduct the site visit on Thursday, March 25. I should talk to Frank Day, who will accompany me, about finalizing the time.
Frank Day	Kern County Department of Airports	(805) 393-7990	3/17/93	A site visit was set up for Thursday, March 25 at 9:15 a.m. Meet at his office at the Bakersfield Airport. Unibar Drilling Fluids is currently operating on site. The general manager is Tom Jester who can be reached at (805) 797-2479.

CONTACT REPORT

REFERENCE 9

AGENCY/AFFILIATION: Kern County		
DEPARTMENT: Airports		
ADDRESS: 1401 Skyway Drive, Suite 200	CITY: Bakersfield	
COUNTY: Kern	STATE: CA	ZIP: 93308
CONTACT(S)	TITLE	PHONE
Frank Day	Manager of Operations and Maintenance	(805) 393-7990
BEI PERSON MAKING CONTACT: Jordie Bornstein JB JB		DATE: 4/5/93
SUBJECT: Historical lease and use information for Lost Hills Airport		
SITE NAME: Farm Flite Ag. Service	EPA ID: CAD 983650078	

DISCUSSION:

Kern County Department of Airports is the owner and operator of the Lost Hills Airport.

The runway at the Lost Hills Airport is currently used by eight agricultural pesticide application companies for taking off, landing and loading of their airplanes. In addition, the airport has two leasable parcels, one in the southern portion of the airport and one in the northern portion near the runway. The northern parcel includes an airplane hangar and an underground fuel tank, the southern parcel is 9,000 square feet. Mr. Day was not aware of any dry wells located on either parcel.

Northern parcel

Lost Hills Flying Service, an aerial pesticide applicator, began to lease this area in 1979. In 1980 the owner, DeRoy Simpson, built the airplane hangar that presently occupies the parcel. It is uncertain when Lost Hills Flying Service ceased operations on the parcel; however, Kern County Airports purchased the hangar from Nancy Hood (wife and survivor of Mr. Simpson) in June 1987. From December 1987 to November 1990, Kaweah Crop Dusters operated an aerial pesticide application business on the parcel.

CONTACT REPORT (Cont'd)

AGENCY/AFFILIATION: Kern County		
CONTACT(S)	TITLE	PHONE
Frank Day	Manager of Operations and Maintenance	(805) 393-7990
SITE NAME: Farm Flite Ag. Service		EPA ID: CAD 983650078

DISCUSSION: Cont'd

From May 1991 until the present, the southernmost building has been rented for the storage of aircraft. In addition, one family currently lives on the parcel. The family rents one building on the parcel due to its proximity to Richey Farms, their place of employment. Mr. Day stated that he does not have a record of the date the family began living on the parcel. Mr. Day assumed that the parcel was essentially vacant during any dates for which he does not have records of a lessee.

Southern parcel

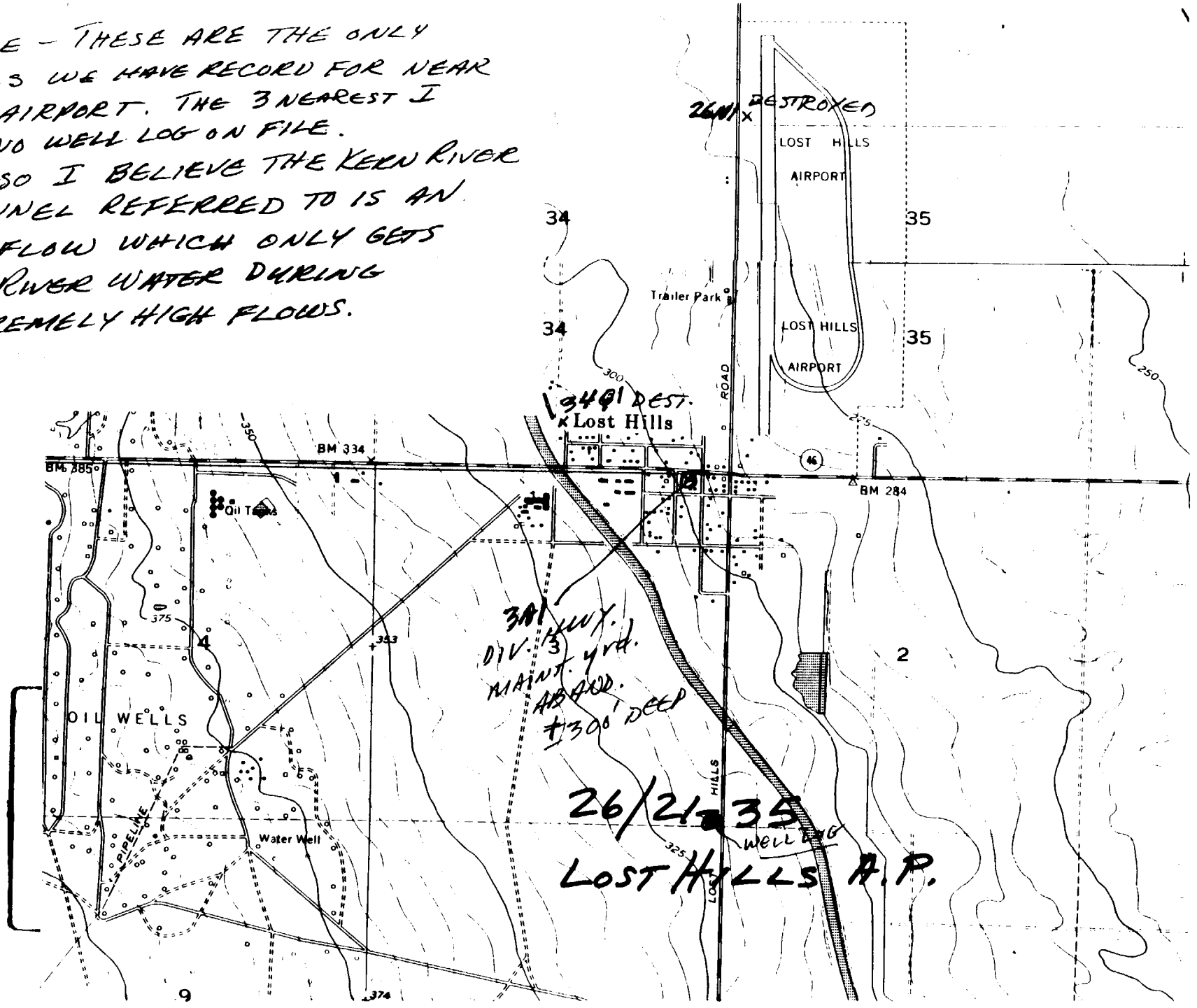
In October 1987 Farm Flite Ag. Service owners, Marion Goolsby and John Gillis, brought the trailers on site and constructed the building which both are presently on the parcel. In December 1987, James Payne and Roland Johnson took over the business and lease. However, the business and lease was again transferred back to Mr. Goolsby and Mr. Gillis at some point prior to 1991. In 1991, Unibar Drilling Fluids subleased the parcel from Farm Flite Ag. Service. Farm Flite Ag. Service currently owns the building and trailers on the parcel and is named in the lease as lessee.

Mr. Day has documentation that in July 1983, Farm Flite Ag. Service entered into a lease agreement with Kern County Airports; however, Mr. Day is uncertain whether this lease was for the northern or southern parcel.

CONTACT CONCURRENCE: _____ DATE: _____

JORDIE - THESE ARE THE ONLY WELLS WE HAVE RECORD FOR NEAR THE AIRPORT. THE 3 NEAREST I HAVE NO WELL LOG ON FILE.

ALSO I BELIEVE THE KERN RIVER CHANNEL REFERRED TO IS AN OVERFLOW WHICH ONLY GETS KERN RIVER WATER DURING EXTREMELY HIGH FLOWS.



REFERENCE 10

CONTACT LOG (Cont'd)

Site: Farm Flite Ag. Service

Name	Affiliation	Phone	Date	Information
Frank Day	Kern County Department of Airports	(805) 393-7990	5/4/93	The runway and concrete apron are not considered part of the northern leasable parcel. The parcel is approximately 150,000 square feet. Submit written request to view files to Ted Anderson.
Dennis Williams	California Department of Water Resources	(209) 445-5044	5/10/93	He does not have documentation on drinking water wells within 4 miles of the site. The log for a well he originally identified as located in Township 27, Range 21, Section 3 does not exist. He has no information on the destruction date for the well shown on the map he sent last week. The wells were probably used by transient cattle herders for watering stock.
John Johnson	John Carollo Engineers	(805) 665-0116	5/13/93	Verified that drinking water for Lost Hills is supplied by wells 13 miles east of town. The water is transported through a 12-inch plastic pipeline to an enclosed reservoir tank 2 miles west of town.

REFERENCE 12

QUICK CHECK

ABANDONED SITE PROGRAM DRIVE-BY RECORD

Site Name: Farm Flite Ag Service

Site Location: Lost Hills Rd - Lost Hills airpt. Lost Hills

Facility File Number: 15-07-0027

1. Status: a. Active (✓) b. Different company _____
   Inactive ( )

2. Setting: a. Urban ( ) b. Residential ( ) c. Near:
   Suburban ( ) Commercial ( ) RR tracks ( )
   Rural (✓) Industrial ( ) Drainage ( )
   Agricultural ( ) _____ Freeway ( )

   d. Paved ( ) e. Unrestricted access ( )
   Partial pave (✓) Restricted access — has fence
   Unpaved ( )

3. Waste Containment: a. Pond ( ) Trash can ( ) b. Stored on: Ground (✓)
   Pit ( ) Dumpster (✓) Paving ( )
   Ditch ( ) Bag/Sack ( ) Pallet (✓)
   Pail/Can ( ) Piled ( ) 2ndary contain. ( )
   Drum/Bbl ( ) Scattered ( )
   Tanks (✓)

   no wastes observed

4. Waste Description (Quantities, labeling): a. Inert ( ) Solid ( ) b. Color none observed -
   Garbage ( ) Sludge ( )
   Indstrl ( ) Liquid ( )

   no bag wastes observed at this facility.

5. Misc. a. Site observability good b. Odors none detected
   c. Vegetation weeds d. Topography flat

6. Land Use (Surrounding area): site #3 is surrounded by base land - a larger warehouse that "holds" small planes is on the same property due NO. of this facility. Lost Hills airport is also in this same "complex".

DHS 8422 (1/88)

QUICK CHECK

7. Distance to surface water (including intermittent streams): none observed

8. Distance to food processing/packaging or agricultural production: none observed

9. Proximity of day care centers, hospitals, nursing homes, schools or other "sensitive" populations: none observed

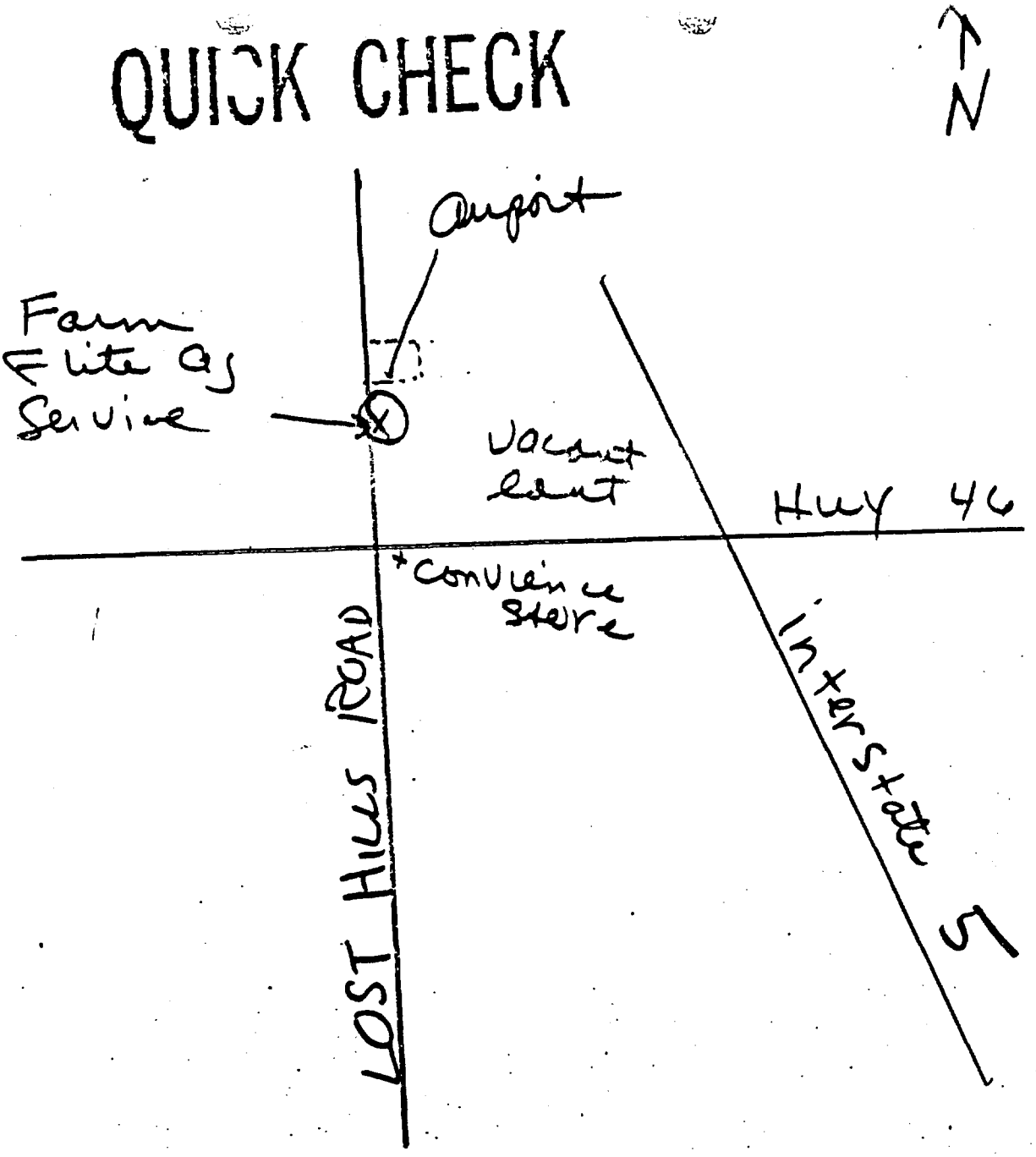
10. Estimate the number of people living and/or working in the immediate vicinity of the site: 3

11. Proximity to sensitive environment/ecosystem? (list) none observed

12. Map & Comments — Present a graphic site description. Draw, describe, and comment on the following: buildings, paving, storage (raw materials, products, and/or wastes), security, vacant areas, and housekeeping practices. Identify streets, landmarks, and directions. Label other pertinent data.

Site located on Lost Hills road in the "town" of Lost Hills" — easy to see from the road — site consists of a mobile trailer (office), a large garage (fits small planes) and a few vertical tanks. There was also a large dumpster - appeared to be garbage, smashed cans (drums?) + paper.

QUICK CHECK



rather desolate area. Can see tanks and dumpster from Lost Hills Road. Fence surrounds site. Rather small operation.

Name: Astrid Jol

Date: 6/29/88.

DHS 8422 (1/88)

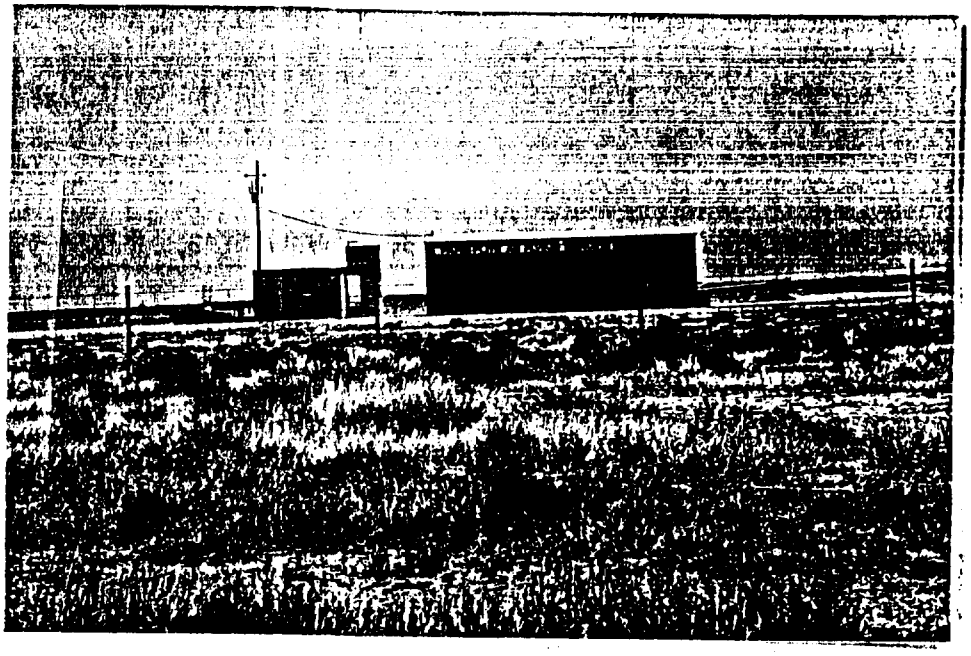
QUICK CHECK

FIELD PHOTOGRAPH LOG SHEET

TIME 10.45 (AM) PM

DIRECTION: N (E) S W

SAMPLE ID #

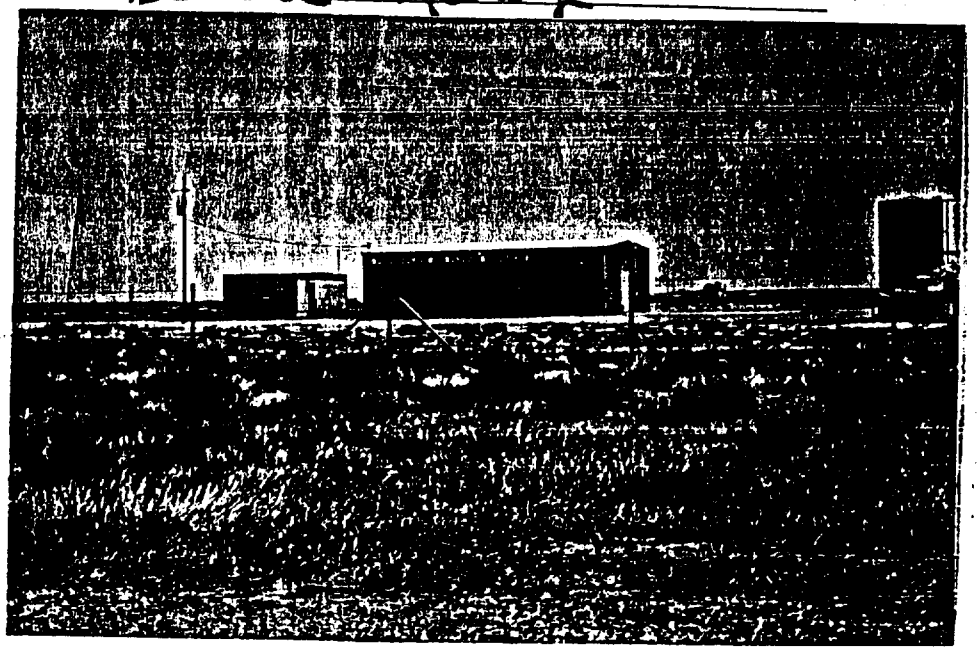


DESCRIPTION: Office is small trailer. Small operation. Plane behind "yard"

TIME: 10.47 (AM) PM

DIRECTION: N (E) S W

SAMPLE ID #



DESCRIPTION: Vertical tank at right of photo dumpsters to right of (in front of)

Site Name: Farm Flite Ag Service ASPIS # 15-07-0027

Address: Lost Hills Rd

Lost Hills Airport - Lost Hills EPA #

Photographed By: Astrid Johnson Date: 6/29/88

Weather Conditions: Hot 92°F Camera: Ricoh DX Auto

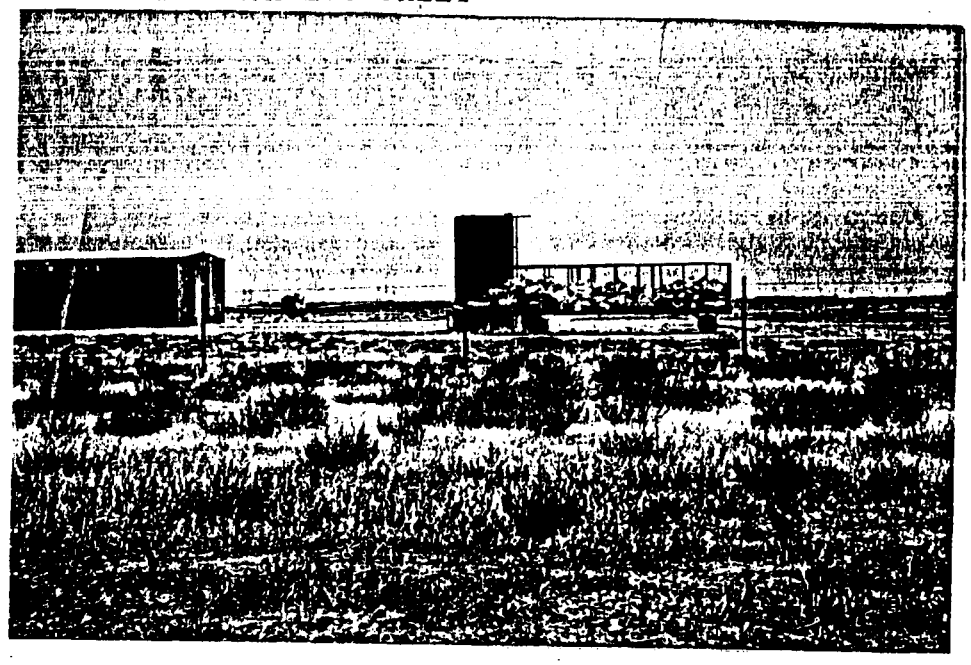
QUICK CHECK

FIELD PHOTOGRAPH LOG SHEET

TIME: 10:50 (AM) PM

DIRECTION: N (E) S W

SAMPLE ID #

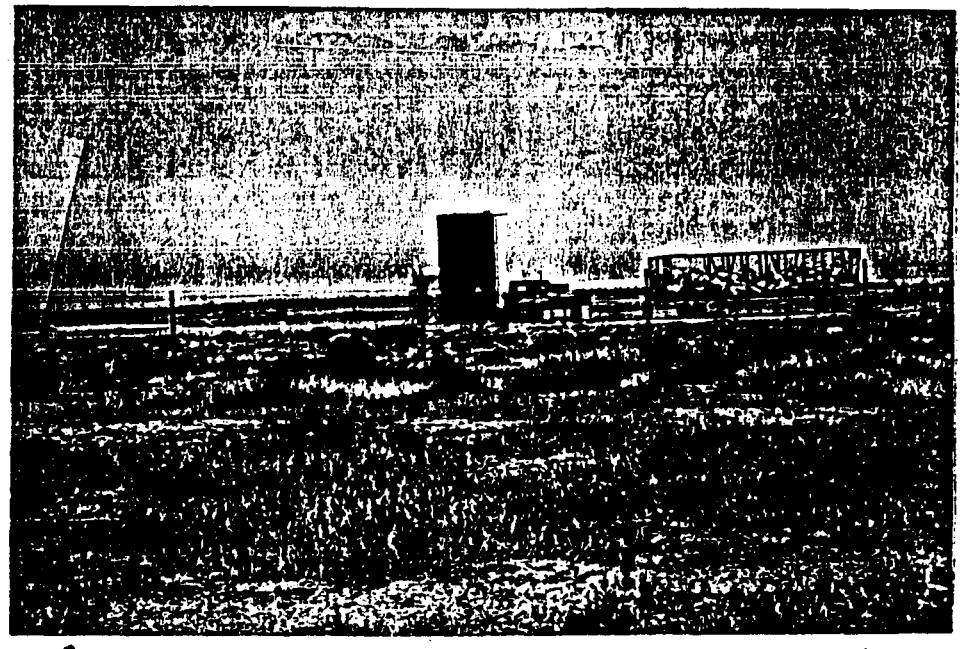


DESCRIPTION: taken from Lost Hills Road office to left (NO) of photo

TIME: 10:55 (AM) PM

DIRECTION: N (E) S W

SAMPLE ID #



DESCRIPTION: see above

Site Name: Farm Flite Ag Service ASPIS # 15-07-0027

Address: Lost Hills Rd

Lost Hills Airport - Lost Hills EPA #

Photographed By: Astrid Acuna Date: 6/29/88

Weather Conditions: Hot 92°F Camera: Ricoh

DX Auto

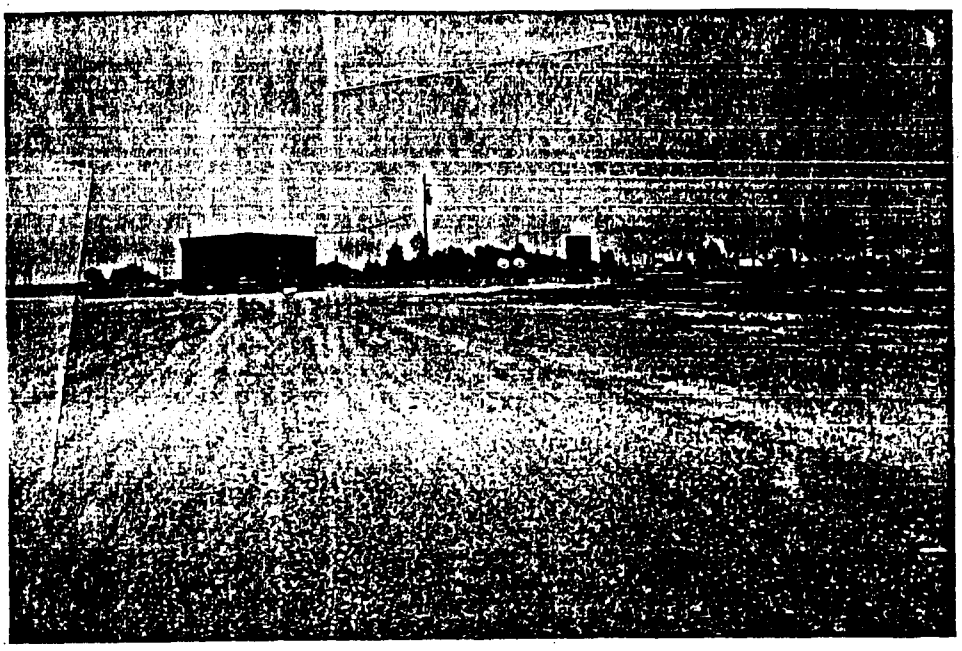
QUICK CHECK

FIELD PHOTOGRAPH LOG SHEET

TIME: 11:05 (AM) PM

DIRECTION: N E (S) W

SAMPLE ID #

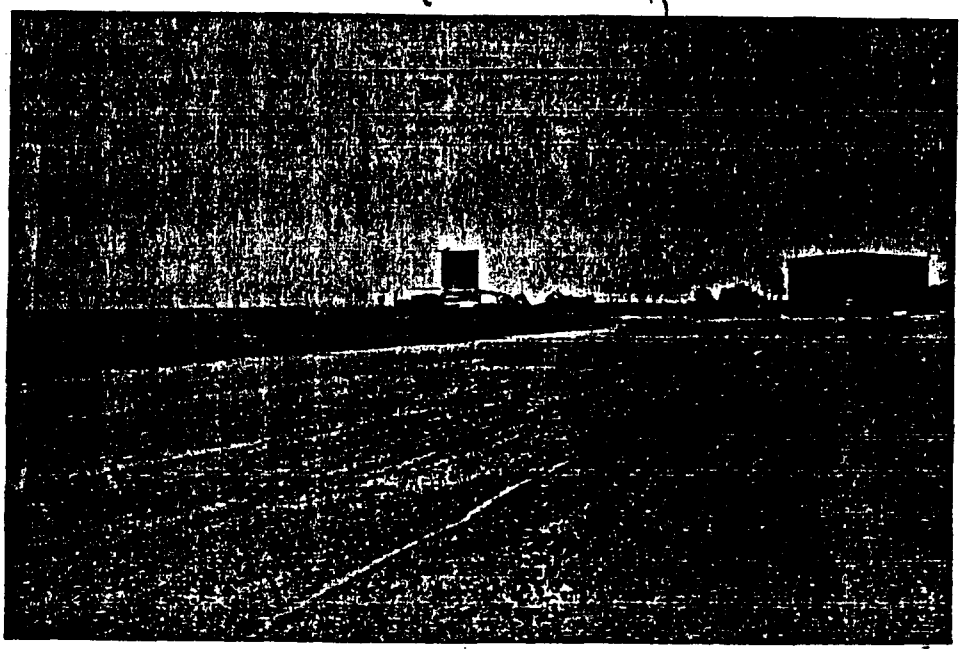


DESCRIPTION: inside the gate — office to left. "airport" behind me (NO) of this photo

TIME: 11:10 (AM) PM

DIRECTION: N E (S) W

SAMPLE ID #



DESCRIPTION: dumpster to right of photo (west)

Site Name: Farm Flite Ag Service ASPIS # 15-07-0027

Address: Lost Hills Rd

Lost Hills Airport - Lost Hills EPA #

Photographed By: Astrid Acuna Date: 6/29/88

Weather Conditions: Hot 92°F Camera: Ricoh DX Auto

FACILITY NAME/ RCRA ID	FACILITY ADDRESS	CONTACT NAME	TELEPHONE	NOTIF DATE	CAL DIST/ COUNTY	FACILITY TYPE TSD	GEN	TRN	BBL	RCY
FARIS DOM? ?N TRUCKING CAD980694905	2482 GAIL DR	E. MANAGER	(714)681-0572 RIVERSIDE	11/19/82 CA 92509	4 RIVERSIDE	-	-	TRN	-	-
FARM & ORCHARD INTL CAD982349359	2865 W BIGGS GRIDLEY RD	E. MANAGER	(916)846-6375 BIGGS	10/23/87 CA 95917	1 BUTTE	-	-	-	-	-
FARMER BROS CO CAD982018970	20333 S NORMANDIE	E. MANAGER	(213)320-1212 TORRANCE	07/30/87 CA 90509	4 LOS ANGELES	-	-	-	-	-
FARMERS AERIAL SVC CAD980889216	17500 W HOBSON WAY	N. NONNOTIF	( ) - BLYTHE	08/03/92 CA 92225	RIVERSIDE	TSD	-	-	-	-
FARMERS MERCANTILE CAD982038705	721 ABBOTT ST	E. MANAGER	(408)484-7383 SALINAS	09/23/87 CA 93901	2 MONTEREY	-	-	-	-	-
FARMERS TRACTOR & EQUIPMENT CAD983591934	1132 S MAIN ST	G. DAN	(209)784-4967 PORTERVILLE	06/27/91 CA 93257	5 TULARE	-	LQG	-	-	-
FARR CO CAD008354821	2301 ROSECRANS AVE	E. MANAGER	(213)772-5221 EL SEGUNDO	07/24/80 CA 90245	3 LOS ANGELES	-	*LG	-	-	-
FARR COMPANY CORCORAN PLANT CAD982028326	500 INDUSTRIAL WAY	D. GOMEZ	(209)992-5118 CORCORAN	07/05/91 CA 93212	5 KINGS	-	LQG	-	-	-
FARR COMPANY CORPORATE OFFICE CAD982028268	2221 PARK PL	E. MANAGER	(213)772-5221 EL SEGUNDO	07/06/87 CA 90245	3 LOS ANGELES	-	LQG	-	-	-
FARR COMPANY RIALTO PLANT CAD982028383	300 S CEDAR AVE	E. MANAGER	(714)820-6800 RIALTO	07/06/87 CA 92376	4 SAN BERNARDINO	-	LQG	-	-	-
FARR W CONSTRUCTION CAD980894141	2500 PETALUMA BLVD N	E. MANAGER	(707)795-8443 PETALUMA	04/02/85 CA 94952	2 SONOMA	-	-	TRN	-	-
FARRAR AUTO WORKS INC. CAD982370330	240 NO. VENTURA AVE	E. MANAGER	(805)648-5257 VENTURA	04/18/88 CA 93006	3 VENTURA	-	LQG	-	-	-
FARREL IND INC CAD041158015	1736 POTRERO AVE	E. MANAGER	(213)579-4574 SOUTH EL MONTE	08/18/80 CA 91733	3 LOS ANGELES	-	LQG	-	-	-
FARRELL LINES INC CAD060136454	1 MARKET PLZ	E. MANAGER	(415)777-3300 SAN FRANCISCO	08/15/80 CA 94105	2 SAN FRANCISCO	-	-	TRN	-	-
FARRELLS TRUSS CAD982444853	22700 BROADWAY	E. MANAGER	(707)938-8444 SONOMA	12/17/90 CA 95476	2 SONOMA	-	SQG	-	-	-
FARRIESTERS AUTO WRECKERS CAD981973878	547 CROWS LANDING RD	E. MANAGER	(209)524-4473 MODESTO	05/07/87 CA 95351	1 STANISLAUS	-	LQG	-	-	-

REFERENCE 13

DONED SITE PROJECT

FINAL DISPOSITION

REFERENCE 14

Name Bobbi Small

Date 2/7/83

Site Name Farm Flite Ag Service

Site Address Lost Hills Airport

City Lost Hills Zip Code 93249 County Kern

RCRA # _____ Superfund # _____ SWIS # _____

REFERRAL: Date(s) referred: 2/7/83

Referral Agency Name(s): HWMB/ENF

Reason referred: Discharge rinsewater to 2 dry wells

INCLUDE IN ASP SITE SUMMARIES: (date and initial)

	Yes	No (explain below)
Lead Person	_____	_____
Regional Administrator	_____	_____
Project Manager	_____	_____
Other	_____	_____

Reason for not including in the site summaries: _____

SC 2/7/83

SITE INFORMATION

COUNTY: ____

Site Name, Address, Phone: Farm Flite Ag Service (805) 797-2601

SIC Code: 07 ___ Lost Hills Airport Lost Hills Ca. 93249

Contact Name, Address, Phone: _____

Site Number: 15-07-0027 City Code: 0000 APN: _____ TRS: _____

DMS: _____ N: _____ W: _____ Mean Precipitation: _____ Land Use: _____

Distance to Drinking Water: _____ N E S W Depth to Groundwater: _____ N E S W

Aerial Photo Date: _____

Agencies Contacted: RWQCB ____ Co. Envir. Health ____ Public Works ____ SWMB ____ ARB ____

Fire ____ Other Agencies: _____

Primary Agency Responsibility: _____ Staff Person Responsible: _____

Site Condition: Pits ____ Ponds ____ Mounds ____ Wells ____ Injection Wells ____

Barrels ____ Tanks ____ Land Spreading ____ Stressed Vegetation ____

Spills ____ Other _____

Waste Characteristics: Liquids ____ Solid ____ Sludge ____ Gas ____ Unknown ____

Waste Categories: Corrosive ____ Toxic ____ Reactive ____ Flammable ____

Sensitizer/Irritant ____ Pressure Generator ____ Radioactive ____

Chemicals Suspected: _____

Chemical Analysis Results: _____

ACTIONS

ACTION CODE	ACTION DATE MM DD YY	COMMENTS
2101	10 01 82	Identified from movie book
2115	12/13/82	RWQCB Records Searched
2104	1/20/83	ASP Site Inspection
2116	2/7/83	Ref to HWMB/ENF for further action
2118	2/7/83	Dschg rinsewater to dry wells

PRIORITIZATION CRITERIA FOR PENDING INVESTIGATION

HWMB, PS&E, FRESNO DISTRICT OFFICE

Farm Flite Ag Service

	CRITERIA ITEM	PRIORITY		
		HIGH	MEDIUM	LOW
1	Contamination:	Known X	Suspected ___	Unknown ___
2	Nature of Waste:	Extremely Dangerous (E.H., Flammable, Reactive, etc.) X	Dangerous (Heavy Metals, Corrosive, etc.) ___	Moderately Dangerous ___ (Low Concentration)
3	Magnitude of Contamination:	Major ___	Moderate X	Minor ___
4	Pollution Impact:	Known X	Suspected ___	Unknown ___
5	DOHS Responsibility:	Solely ___	Shared X	Minor ___
6	Public Exposure:	High ___ (Free Access, High Population Density)	Medium X (Fenced, Remote Location)	Low ___ (Fenced, Guarded)
7	Violation of HWCL:	Major X (Illegal Disposal)	Moderate ___ (Storage >90 days, Sloppy Yard)	Minor ___ (Generator Violations)
8	Responsible Party:	Known X	Suspected ___	Unknown ___
9	Other Factors:	disposal of rinsate to two dry wells.		
	Total	6	3	∅
	Staff Recommendation			

Approval: _____

SC

MEMORANDUM - KERN COUNTY

DEPARTMENT OF AIRPORTS

August 27, 1987

TO: RICHARD CASAGRANDE
HEALTH DEPARTMENT

GEN AD 80

FROM: LAWRENCE GALINDO, C.P.M.
AVIATION DIRECTOR

SUBJECT: LOST HILLS AIRPORT - REMOVAL OF CHEMICALS

Attached is a list of chemicals that were found abandoned at the Lost Hills airport sometime during the month of July. All of the chemical product was left in containers consequently there was no spillage involved. After research and inventory, the Department of Airports concludes that these chemicals predominantly consist of current products being applied by local agricultural operators.

Subsequent to our notification and discussion with your office the decision was made to allow a reputable agricultural aerial applicator to claim and utilize these products and make appropriate arrangements for any residue. As a consequence all chemicals were transferred to Kaweah Crop Dusters who indicated they would be able to utilize the material in their spraying operations. They are capable of properly handling, identifying, and using these chemical products and are aware of the environmental rules and regulations regarding handling and disposal. We hope this information is sufficient for you at this time. We will notify you when Kaweah has taken possession of the chemicals. If you should have any further questions please feel free to contact our office.

LG:teh

cc: Bob Edwards
Agricultural Commissioner

MEMORANDUM - KERN COUNTY

DEPARTMENT OF AIRPORTS

August 21, 1987

MEMO TO FILE

LIST OF CHEMICAL FOUND AND DISPOSED OF AT LOST HILLS AIRPORT

Cygon 267, (25 gals)
Azadrin (1 gal)
Thymet liquid 600, (7 gals)
Thymet 15G (150 lbs)
Lanate, (1 lb)
Weedone 24D (3 gals)
Superside (1 gal)
Bactur-W100
Thuraside, HP50
Drift added.
Nalcoltrol
Airdrop (25 qts)
Target 100 (8 lb bags)
Nutrient Buffer (5 gals)
Manzat 00 (100 lbs)
Dawpon 0 lbs)

Kern County Health Department
Division of Environmental [illegible]
1700 Flower Street, Bakersfield, CA 93305
(805) 861-3636

Permit No. [illegible]
ation Date 6-1-87

REFERENCE 16

APPLICATION FOR PERMIT TO OPERATE UNDERGROUND HAZARDOUS SUBSTANCES STORAGE FACILITY

Type Of Application (check):
☐ New Facility ☐ Modification Of Facility ☒ Existing Facility ☐ Transfer Of Ownership

A. Emergency 24-Hour Contact (name, area code, phone): Days 393-7990
Nights "

Facility Name LOST HILLS FLYING SERVICE No. Of Tanks 1
Type Of Business (check): ☐ Gasoline Station ☒ Other (describe) FBO
Is Tank(s) Located On An Agricultural Farm? ☐ Yes ☒ No
Is Tank(s) Used Primarily For Agricultural Purposes? ☐ Yes ☒ No
Facility Address LOST HILLS AIRPORT Nearest Cross St. HWY 46
T _____ R _____ SEC _____ (Rural Locations Only)
Owner DEPT OF AIRPORTS KERN COUNTY Contact Person MATTHEW ETCHEVERRY
Address 1401 SKYWAY DR Zip 93308 Telephone 393-7990
Operator " " Contact Person "
Address " " Zip " Telephone "

B. Water To Facility Provided By COUNTY Depth to Groundwater 300 F
Soil Characteristics At Facility SANDY-LOAM
Basis For Soil Type and Groundwater Depth Determinations SURROUNDING FARMS

C. Contractor N/A CA Contractor's License No. _____
Address _____ Zip _____ Telephone _____
Proposed Starting Date _____ Proposed Completion Date _____
Worker's Compensation Certification No. _____ Insurer _____

D. If This Permit Is For Modification Of An Existing Facility, Briefly Descri
Modifications Proposed _____

E. Tank(s) Store (check all that apply):

Tank #	Waste	Product	Motor Vehicle Fuel	Unleaded	Regular	Premium	Diesel	Waste Oil
1	☐	☐	☒	☒	☐	☐	☐	☐
_____	☐	☐	☐	☐	☐	☐	☐	☐
_____	☐	☐	☐	☐	☐	☐	☐	☐
_____	☐	☐	☐	☐	☐	☐	☐	☐

F. Chemical Composition Of Materials Stored (not necessary for motor vehicle fuels)

Tank #	Chemical Stored (non-commercial name)	CAS # (if known)	Chemical Previously Stored (if different)
_____	N/A		
_____			
_____			
_____			

G. Transfer Of Ownership
Date Of Transfer 6-2-87 Previous Owner DEROY & NANCY SIMPS
Previous Facility Name LOST HILLS FLYING SERVICE
I, _____ accept fully all obligations of Permit No. _____ issued _____. I understand that the Permitting Authority may review a modify or terminate the transfer of the Permit to Operate this underground storag facility upon receiving this completed form.

This form has been completed under penalty of perjury and to the best of my knowledge is tru and correct.

Signature [signature] Title AVIATION DIRECTOR Date 6/25/87

Kern County Health Department
Division of Environmental
1700 Flower Street, Bakersfield, CA 93305
(805) 861-3636

Permit No. 15286C
tion Date 02-04-88 34

APPLICATION FOR PERMIT TO OPERATE UNDERGROUND HAZARDOUS SUBSTANCES STORAGE FACILITY

Type Of Application (check):
☐ New Facility ☐ Modification Of Facility ☒ Existing Facility ☐ Transfer Of Ownership

A. Emergency 24-Hour Contact (name, area code, phone): Days (805) 393-7990 Lawrence Gali
Nights (805) 393-3868 Lawrence Gali

Facility Name Lost Hills Airport No. Of Tanks 1
Type Of Business (check): ☐ Gasoline Station ☒ Other (describe) Fixed Base Operator
Is Tank(s) Located On An Agricultural Farm? ☐ Yes ☒ No
Is Tank(s) Used Primarily For Agricultural Purposes? ☐ Yes ☒ No
Facility Address Lost Hills Rd. Nearest Cross St. Hwy 46
T _____ R _____ SEC _____ (Rural Locations Only)
Owner Kern County Dept. of Airports Contact Person Lawrence Galindo
Address 1401 Skyway Dr. Suite 200 Zip 93308 Telephone (805) 393-7990
Operator Kaweah Crop Dusters Contact Person Mike Albaugh
Address 2530 West Goshen Ave. Visalia Zip 93277 Telephone (209) 732-6673

B. Water To Facility Provided By Lost Hills Water District Depth to Groundwater 300 fee
Soil Characteristics At Facility loam
Basis For Soil Type and Groundwater Depth Determinations surrounding farms

C. Contractor _____ CA Contractor's License No. _____
Address _____ Zip _____ Telephone _____
Proposed Starting Date _____ Proposed Completion Date _____
Worker's Compensation Certification No. _____ Insurer _____

D. If This Permit Is For Modification Of An Existing Facility, Briefly Descri
Modifications Proposed _____

E. Tank(s) Store (check all that apply):

Tank #	Waste	Product	Motor Vehicle Fuel	Unleaded	Regular	Premium	Diesel	Waste Oil
1	☐	☒ Aviation	☐	☐	☐	☐	☐	☐
	☐	☐ Gas	☐	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐	☐	☐	☐

F. Chemical Composition Of Materials Stored (not necessary for motor vehicle fuels)

Tank #	Chemical Stored (non-commercial name)	CAS # (if known)	Chemical Previously Stored (if different)
1	Aviation fuel (100-130 low lead)	unknown	

G. Transfer Of Ownership
Date Of Transfer _____ Previous Owner _____
Previous Facility Name _____
I, _____ accept fully all obligations of Permit No. _____ issued t
_____. I understand that the Permitting Authority may review a
modify or terminate the transfer of the Permit to Operate this underground storag
facility upon receiving this completed form.

This form has been completed under penalty of perjury and to the best of my knowledge is true and correct.

Signature [signature] Title Aviation Director Date 02-04-88

TANK # _____ (FILL OUT SEPARATE FORM FOR EACH TANK) 4500 76 C 34

FOR EACH SECTION, CHECK ALL APPROPRIATE BOXES

I. 1. Tank is: ☐ Vaulted ☐ Non-Vaulted ☒ Double-Wall ☐ Single-Wall

2. Tank Material
☐ Carbon Steel ☐ Stainless Steel ☐ Polyvinyl Chloride ☐ Fiberglass-Clad St
☒ Fiberglass-Reinforced Plastic ☐ Concrete ☐ Aluminum ☐ Bronze ☐ Unknown
☐ Other (describe): _____

3. Primary Containment

Date Installed	Thickness (Inches)	Capacity (Gallons)	Manufacturer
02-20-80	¼"	10,000	unknown

4. Tank Secondary Containment
☒ Double-Wall ☐ Synthetic Liner ☐ Lined Vault ☐ None ☐ Unknown
☐ Other (describe): _____ Manufacturer: _____
Material _____ Thickness (Inches) _____ Capacity (Gals.) ___

5. Tank Interior Lining
☐ Rubber ☐ Alkyd ☐ Epoxy ☐ Phenolic ☐ Glass ☐ Clay ☐ Unlined ☐ Unkn
☒ Other (describe): mylar

6. Tank Corrosion Protection
☐ Galvanized ☒ Fiberglass-Clad ☐ Polyethylene Wrap ☐ Vinyl Wrapping
☐ Tar or Asphalt ☐ Unknown ☐ None ☐ Other (describe): _____
Cathodic Protection: ☒ None ☐ Impressed Current System ☐ Sacrificial Anode Sys
☐ Describe System & Equipment: _____

7. Leak Detection, Monitoring, and Interception
a. Tank: ☐ Visual (vaulted tanks only) ☐ Groundwater Monitoring Well(s)
☐ Vadose Zone Monitoring Well(s) ☐ U-Tube Without Liner
☐ U-Tube with Compatible Liner Directing Flow To Monitoring Well(s)*
☐ Vapor Detector * ☐ Liquid Level Sensor * ☐ Conductivity Sensor*
☐ Pressure Sensor In Annular Space Of Double Wall Tank * _____
☐ Liquid Retrieval & Inspection From U-Tube, Monitoring Well Or Annular Spac
☒ Daily Gauging & Inventory Reconciliation ☐ Periodic Tightness Testing
☐ None ☐ Unknown ☐ Other _____
b. Piping: ☐ Flow-Restricting Leak Detector(s) For Pressurized Piping*
☐ Monitoring Sump With Raceway ☐ Sealed Concrete Raceway
☐ Half-Cut Compatible Pipe Raceway ☐ Synthetic Liner Raceway ☐ None
☒ Unknown ☐ Other _____
*Describe Make & Model: _____

8. Tank Tightness
Has This Tank Been Tightness Tested? ☒ Yes ☐ No ☐ Unknown
Date Of Last Tightness Test 02-02-80 *Results Of Test* no leaks
Test Name held 5 psi for one hour Testing Company _____

9. Tank Repair
Tank Repaired? ☐ Yes ☒ No ☐ Unknown
Date(s) Of Repair(s) _____
Describe Repairs _____

10. Overfill Protection
☒ Operator Fills, Controls, & Visually Monitors Level
☐ Tape Float Gauge ☐ Float Vent Valves ☐ Auto Shut-Off Controls
☐ Capacitance Sensor ☐ Sealed Fill Box ☐ None ☐ Unknown
☐ Other: _____ List Make & Model For Above Devi

11. Piping
a. Underground Piping: ☐ Yes ☒ No ☐ Unknown Material _____
Thickness (inches) _____ Diameter _____ Manufacturer _____
☐ Pressure ☒ Suction ☐ Gravity Approximate Length Of Pipe Run _____
b. Underground Piping Corrosion Protection:
☐ Galvanized ☐ Fiberglass-Clad ☐ Impressed Current ☐ Sacrificial An
☐ Polyethylene Wrap ☐ Electrical Isolation ☐ Vinyl Wrap ☐ Tar or Asph
☐ Unknown ☐ None ☐ Other (describe): _____
c. Underground Piping, Secondary Containment:
☐ Double-Wall ☐ Synthetic Liner System ☐ None ☐ Unknown
☐ Other (describe): _____

REFERENCE 17

906 00015

CONTACT REPORT

AGENCY/AFFILIATION: Kern County Resource Management Agency		
DEPARTMENT: Environmental Health Services Department (EHSD)		
ADDRESS: 2700 M Street	CITY: Bakersfield	
COUNTY: Kern	STATE: CA	ZIP: 93301

CONTACT(S)	TITLE	PHONE
Barbara Houghton	Hazardous Materials Specialist	(805) 861-3636

BEI PERSON MAKING CONTACT: Jordie Bornstein JB	DATE: 4/5/93
SUBJECT: EHSD involvement with activities at Lost Hills Airport	
SITE NAME: Farm Flite Ag. Service	EPA ID: CAD 983650078

DISCUSSION:

From approximately 1991 until 1992, Ms. Houghton conducted routine inspections of Lost Hills Flying Service. The company was a pesticide application service which operated out of an area in the northern portion of the Lost Hills Airport near the runway. Although the company went out of business in 1990, the EHSD continues to inspect the site to ensure that their underground storage tank is maintained. The business was not in operation during any of the inspections which Ms. Houghton conducted.

Farm Flite Ag. Service was a distinctly separate pesticide application service which operated out of an area in the southern portion of the Lost Hills Airport. To the best of her knowledge, Ms. Houghton stated that the EHSD has not been involved with this operation in any capacity as no underground storage tanks are known to exist on the site.

CONTACT CONCURRENCE: B. L. Houghton DATE: 4/12/93

RANDALL L. ABBOTT
DIRECTOR

DAVID PRICE III
ASSISTANT DIRECTOR

Environmental Health Services Department
STEVE McCALLEY, REHS, DIRECTOR

Air Pollution Control District
WILLIAM J. RODDY, APCO

Planning & Development Services Department
TED JAMES, AICP, DIRECTOR

ENVIRONMENTAL HEALTH SERVICES DEPARTMENT

April 3, 1992

Mr. Frank Day
Kern County Department of Airports
1401 Skyway Drive, Suite 200
Bakersfield, CA 93308

Re: Lost Hills Airport, Permit to Operate No. 450034

Dear Mr. Day:

A routine inspection was conducted at said facility on March 31, 1991. Please refer to the enclosed inspection form for comments and recommendations.

Before the tank is put back in service, the following upgrades will be required:

1. Installation of an interstitial probe that will activate an audible and visual alarm should a release occur.
2. Installation of a product tight overfill box with a five gallon capacity.
3. If the dispensing system is pressurized, a product reducing line leak detector or alternative must be installed.

If you have any question, please call me at (805) 861-3636, extension 577.

Sincerely,

B. D. Houghton

Barbara D. Houghton
Hazardous Materials Specialist
Hazardous Materials Management Program

BH:jg

KERN COUNTY RESOURCE MANAGEMENT AGENC
ENVIRONMENTAL HEALTH SERVICES DEPARTMENT
2700 "M" STREET, SUITE 300, BAKERSFIELD CA 93301
(805)861-3636

UNDERGROUND HAZARDOUS SUBSTANCE STORAGE FACILITY
* INSPECTION REPORT *

PERMIT# 1500340 TIME IN 1330 TIME OUT _____ NUMBER OF TANKS: 1
PERMIT POSTED? YES _____ NO ✓ INSPECTION DATE: 3/31/92
TYPE OF INSPECTION: ROUTINE ✓ REINSPECTION _____ COMPLAINT _____

FACILITY NAME: LOST HILLS FLYING SERVICE
FACILITY ADDRESS: LOST HILLS AIRPORT
LOST HILLS, CA
OWNERS NAME: DEPARTMENT OF AIRPORTS KERN COUNTY
OPERATORS NAME: DEPARTMENT OF AIRPORTS KERN COUNTY
COMMENTS:
Sent letter 4/3/92

ITEM	VIOLATIONS/OBSERVATIONS
1. PRIMARY CONTAINMENT MONITORING: a. Intercepting an directing system b. Standard Inventory Control c. Modified Inventory Control d. In-tank Level Sensing Device e. Groundwater Monitoring f. Vadose Zone Monitoring	unk - does not appear that tank has been used for some time. Tanks must be MONITORED 2 times per week as per KC guideline UT-15.
2. SECONDARY CONTAINMENT MONITORING: a. Liner b. Double-walled tank c. Vault	SW
3. PIPING MONITORING: a. ~~Pressurized~~ ? b. ~~Suction~~ ? c. ~~Gravity~~	If pipings pressurized ⇒ Install product reducing line leak detectors before tanks is put back in service
4. OVERFILL PROTECTION: Not product tight	Install product tight overspill boxes w/ 5 gal capacity before using ~~tanks~~
5. TIGHTNESS TESTING	unk
6. NEW CONSTRUCTION/MODIFICATIONS	unk
7. CLOSURE/ABANDONMENT	unk
8. UNAUTHORIZED RELEASE	unk
9. MAINTENANCE, GENERAL SAFETY, AND OPERATING CONDITION OF FACILITY	good

COMMENTS/RECOMMENDATIONS Once tanks ~~are~~ put back in service, tanks must be monitored each day fuel is dispensed as per KC Guide 2000 UT-10.

REINSPECTION SCHEDULED? ✓ yes ___ no APPROXIMATE REINSPECTION DATE: Open Workup
INSPECTOR: Livingston REPORT RECEIVED BY: _____

REFERENCE 19

RESOURCE MANAGEMENT AGENCY

RANDALL L. ABBOTT
DIRECTOR

DAVID PRICE III
ASSISTANT DIRECTOR

Environmental Health Services Department
STEVE McCALLEY, REHS, DIRECTOR

Air Pollution Control District
WILLIAM J. RODDY, APCO

Planning & Development Services Department
TED JAMES, AICP, DIRECTOR

ENVIRONMENTAL HEALTH SERVICES DEPARTMENT

February 22, 1991

Kern County Department of Airports
1401 Skyway Drive, Suite 200
Bakersfield, CA 93308

Attention: Frank Day

Subject: Underground Storage Tank, Permit No. 450034
Located at Lost Hills Airport

Dear Mr. Day:

A routine inspection was performed at the Lost Hills Airport on February 20, 1991. Enclosed you will find:

1. Inspection report for the underground storage tank.
2. Inspection form for Phase I Vapor Recovery.
3. Guidance document UT-15, Modified Inventory Control Monitoring.
4. Monitoring forms.

Even though the tank is not being used at this time, monitoring requirements must still be met to detect any leaks that may occur into or out of the tank. In addition, the tank fill pipe must be properly secured to prevent dumping of unwanted materials into the tank.

If you have any questions concerning the inspection or monitoring requirements, please call me at (805) 861-3636, extension 577.

Sincerely,

Barbara Houghton

Barbara Houghton
Hazardous Materials Specialist
Hazardous Materials Management Program

BH:jg

Enclosures

2700 "M" STREET, SUITE 300 BAKERSFIELD, CALIFORNIA 93301 (805) 861-3636
FAX: (805) 861-3429

KERN COUNT' RESOURCE MAI AGEMENT AGE
ENVIR' MENTAL HEALTH SERVICES DE RTMEN
2700 "M" STREET, SUITE 300, BAKERSFIELD, CA 93301
(805)861-3636

UNDERGROUND HAZARDOUS SUBSTANCE STORAGE FACILITY
* INSPECTION REPORT *

PERMIT# 450034C TIME IN 1330 TIME OUT NUMBER OF TANKS: 1
PERMIT POSTED? YES NO INSPECTION DATE: 2/20/91
TYPE OF INSPECTION: ROUTINE X REINSPECTION COMPLAINT

FACILITY NAME: LOST HILLS AIRPORT 797-2052
FACILITY ADDRESS: LOST HILLS ROAD
LOST HILLS
OWNERS NAME: KERN CO. DEPT. OF AIRPORTS
OPERATORS NAME: KAWEAH CROP DUSTERS
COMMENTS:

ITEM	VIOLATIONS/OBSERVATIONS
1. PRIMARY CONTAINMENT MONITORING: a. Intercepting an directing system b. Standard Inventory Control c. Modified Inventory Control d. In-tank Level Sensing Device e. Groundwater Monitoring f. Vadose Zone Monitoring	unknown
2. SECONDARY CONTAINMENT MONITORING: a. Liner b. Double-walled tank c. Vault	unknown
3. PIPING MONITORING: a. Pressurized (circled) b. Suction c. Gravity	Red Jackets must be installed w/in 30 days
4. OVERFILL PROTECTION:	Product tight overfill boxes must be installed w/in 30 days
5. TIGHTNESS TESING	unk
6. NEW CONSTRUCTION/MODIFICATIONS	unk
7. CLOSURE/ABANDONMENT	unk
8. UNAUTHORIZED RELEASE	unk
9. MAINTENANCE, GENERAL SAFETY, AND OPERATING CONDITION OF FACILITY	ok

COMMENTS/RECOMMENDATIONS: No one was at premises. Locks should be placed on fill to prevent theft or illegal dumping

REINSPECTION SCHEDULED? X yes no APPROXIMATE REINSPECTION DATE: 4/91
INSPECTOR: Holcomb REPORT RECEIVED BY:

KE' ' COUNTY AIR POLLUTION CONT)L DISTRICT

2700 "M" Street, Suite 275

Bakersfield, CA. 93301

(805) 861-3682

PHASE I VAPOR RECOVERY INSPECTION FORM

Station Name [illegible] Location [illegible] Rd P/O # [illegible]

Company Mailing Address [illegible] Crop Dusters 1401 Skyway Dr Ste 200 City Bak 93308

Date [illegible] Phone 393-7290 System Type: Sep. Riser / Coaxial

Inspector [illegible] Notice Rec'd By

		TANK #1	TANK #2	TANK #3	TANK #4
1.	PRODUCT (UL, PUL, P, or R)	[illegible]			
2.	TANK LOCATION REFERENCE	[illegible]			
3.	BROKEN OR MISSING VAPOR CAP				
4.	BROKEN OR MISSING FILL CAP				
5.	BROKEN CAM LOCK ON VAPOR CAP				
6.	FILL CAPS NOT PROPERLY SEATED				
7.	VAPOR CAPS NOT PROPERLY SEATED				
8.	GASKET MISSING FROM FILL CAP				
9.	GASKET MISSING FROM VAPOR CAP				
10.	FILL ADAPTOR NOT TIGHT				
11.	VAPOR ADAPTOR NOT TIGHT				
12.	GASKET BETWEEN ADAPTOR & FILL TUBE MISSING / IMPROPERLY SEATED				
13.	DRY BREAK GASKETS DETERIORATED				
14.	EXCESSIVE VERTICAL PLAY IN COAXIAL FILL TUBE				
15.	COAXIAL FILL TUBE SPRING MECHANISM DEFECTIVE				
16.	TANK DEPTH MEASUREMENT	129"			
17.	TUBE LENGTH MEASUREMENT	124"			
18.	DIFFERENCE (SHOULD BE 6" OR LESS)	5"			
19.	OTHER				

20. COMMENTS: [illegible]

[illegible]

☆ **WARNING: SYSTEMS MARKED WITH A CHECK ABOVE ARE IN VIOLATION OF KERN COUNTY AIR POLLUTION CONTROL DISTRICT RULE(S) 209, 412 AND/OR 412.1. THE CALIFORNIA HEALTH & SAFETY CODE SPECIFIES PENALTIES OF UP TO $1,000.00 PER DAY FOR EACH VIOLATION. TELEPHONE (805) 861-3682 CONCERNING FINAL RESOLUTION OF THE VIOLATION(S)** ☆☆☆☆☆☆☆☆☆☆☆☆☆☆☆☆☆☆☆☆☆☆☆☆☆☆☆☆☆☆

APCD FILE

9149-1010

REFERENCE 20

Kern COUNTY DEPARTMENT OF AGRICULTURE

33-021 (REV. 5/85)

PESTICIDE USE MONITORING INSPECTIONS

FIRM/PERSON: Farm Flite Ag Flying Service	APPLICATOR'S NAME:	DATE: 7/12/90	TIME STARTED:
ADDRESS: PO Box 187 Lost Hills CA 93249		EQUIPMENT NO.:	TIME ENDING:
PHONE NO.:	PERMIT NO.:	LICENSE NO: 91044	

☒ Ag PCO ☐ Maint. Gardener ☐ Govt. Agency ☐ Qualified Applicator Certificate ☐ Private App.

BEEKEEPER NOTIFICATIONS REQUIRED ☐ YES ☐ NO

☐ Spray ☐ Granular ☐ Dust ☐ Fumigation ☐ Bait ☐ Other

RECOMMENDATION ☐ YES ☐ NO ADVISER:

OPERATOR OF PROPERTY/OWNER: Farm Flite	LOCATION: Lost Hills Airport	WIND VELOCITY:	DIRECTION:
COMMODITY/SITE:	ADJACENT ENVIRONMENT (N) (S) (E) (W)		

NAME OF PESTICIDE/PRODUCT	REGISTRATION NUMBER FROM LABEL	CAT.	REST. USE	DOSAGE/CONCENTRATION. VOL.

#	YES	NO	N/A	Ref. Section	A. ☐ PRE-APPLICATION SITE INSPECTION
1				6434	Notice of Intent consistent with permit
2			///	6436	Proper target/pest (logical or expected)
3				6436	Proposed app. complies w/permit conditions
4			///	6436	Environ. cond. consistent w/permit and NOI
5				6436	Written recommendation reviewed
6			///	6556	Adequate methods for need to treat
7	///	//	///		Proposed app. approved ☐ YES ☐ NO
8					
9	///		///	Total	

#	YES	NO	N/A	Ref. Section	B. ☐ APPLICATION INSPECTION ☐ AIR ☐ GROUND
1				11701	Licensed-business/individual-proper cat.
2				11732	Registered in County – Business/Pilot
3				6434	Notice of Intent submitted
4			///	12973	Complies with required labeling
5				14007	Complies with permit conditions
6			///	6600	Suitable methods/equip./manner/climate
7			///	6614	Protect. of nontarget prop./animals/persons
8				11909	Apprentice pilot supervised
9				2477(b)	Employee trained
10				2477(b)	Employee supervised (untrained persons)
11				6404-06	Restricted material use under supervision
12				2477(c)	Medical care posting
13			///	12973	Protective equipment worn
14				2480	Warning signs posted
15				6460-64	Drift cont. req./Phenoxy Herb. Specs.
16					
17	///		///	Total	

#	YES	NO	N/A	Ref. Section	C. ☐ FIELD WORKER SAFETY INSPECTION
1			///	2479(a)	Handwashing facilities
2			///	2479(a)	Field supervisor trained
3			///	2479(c)	Reentry compliance/provisions
4			///	2479(a)	Emergency medical care arrangements
5					
6	///		///	Total	

#	YES	NO	N/A	Ref. Section	D. ☐ MIX/LOAD INSPECTION
1				11701	Licensed/proper cat. business/individual
2				11732	Registered in county
3			///	12973	Complies with required labeling
4				2477(b)	Employee trained
5				2477(b)	Employee supervised (untrained persons)
6			///	12973	Protective equipment worn
7				2478(d)	Closed system used
8				2477(g)	Washing facil./Clothing–Cat. I & II
9				2477(c)	Medical care posting
10			///	6604	Accurate measuring devices
11			///	6670(b)	Containers secured and under control
12				6684	Empty containers rinsed at time of use
13				6404-06	Restricted mat. use under supervision
14	///		///	Total	

#	YES	NO	N/A	Ref. Section	E. ☐ EQUIPMENT INSPECTION
1				11732	Equipment registered in County
2				6630	Equipment identified
3				2478(c)	Sight gauge
4				6606	Adequate agitation
5				6610	Backflow prevention
6				6460	Drift cont. noz. specs.–type/size angle
7				12859	Service containers labeled
8			///	6600	Equip. in good repair./safe to operate
9					
10	///		///	Total	

#	YES	NO	N/A	Ref. Section	F. ☒ PESTICIDE STORAGE SITE INSPECTION
1		✓	///	6672(b)	Locked enclosure
2		✓		6674	Storage area posted
3			*	6684	Containers properly rinsed * unknown
4	✓		///	6676	Pesticides labeled
5	✓		///	6680	Pesticides stored in proper containers
6	✓			6412	Possession permit for pesticides stored
7		✓		6670	Control of Containers
8	///	3	///	Total	

REMARKS: Pesticide containers adjacent to the cotton trailer were not kept in a locked, posted enclosure. Several pesticide containers in the same area appear to have used motor oil stored in them.

Signature of Enforcement Officer: Amy J Moore

Acknowledgement of Inspection: Not available to sign

Follow-up Required ☒ YES ☐ NO

Notice of Violation Issued ☒ YES ☐ NO # 0048666

The Noncompliance Items Noted Above Are Violations and Must Be Corrected By: Immediately

REFERENCE 21

STATE OF CALIFORNIA

DEPARTMENT OF FOOD AND AGRICULTURE
PESTICIDE ENFORCEMENT BRANCH

NOTICE OF VIOLATION

004866

33-101 (REV. 9-86)

COUNTY	COUNTY NO.	TIME A.M. P.M.	DATE
Kern	15		7/23/90

NAME: Farm Flite Ag Flying Service — LICENSE NO.: 01044

ADDRESS: P.O. Box 187

CITY: Lost Hills — STATE: CA — ZIP: 93249

LICENSE OR STATUS:
- ☐ ADVISER
- ☐ PILOT
- ☐ GROWER
- ☐ PESTICIDE PRODUCER
- ☒ PCO (AGRICULTURAL)
- ☐ COMM. APP. CERT.
- ☐ GOVT. AGENCY
- ☐ DEALER
- ☐ PCO (STRUCTURAL)
- ☐ FEE-EXEMPT
- ☐ _____

LOCATION OF VIOLATION(S): Lost Hills Airport

SECTIONS VIOLATED	FOOD & AGRICULTURE CODE
6672(b), 6670	ADMINISTRATIVE CODE

NATURE OF VIOLATIONS: Pesticide containers not stored in a locked, posted enclosure. Pesticide containers used to store used motor oil.

PURSUANT TO F & AC SECTION ☐ 11737 ☐ 11896 ☐ 11897 ☐ 13101 ☐ 13102

YOU ARE ORDERED TO CEASE AND DESIST:

ENFORCING OFFICER: David J. Moore, Deputy Ag. Comm. — PHONE: (805) 861-2306

WITHOUT ADMITTING GUILT I AGREE TO: Store all pesticide containers in a locked and properly posted enclosure. Ensure that empty pesticide containers are not reused for any purpose.

SIGNATURE: Sent Certified Mail — TITLE:

WHITE - ISSUING AGENCY
YELLOW - PERSON NOTIFIED
PINK - STATE

86 97020

KERN COU DEPARTMENT OF AGRICULTURE

REFERENCE 22

33-021 (REV. 5/85)

PESTICIDE USE MONITORING INSPECTIONS

FIRM/PERSON: FARM FLITE AG	APPLICATOR'S NAME:	DATE: 8-2-90	TIME STARTED: 11 AM
ADDRESS: P.O. Box 187 LOST HILLS, CA. 93249		EQUIPMENT NO.	TIME ENDING
PHONE NO.: (805) 797-2601	PERMIT NO: —	LICENSE NO: D1044-00000	

☒ Ag PCO ☐ Maint. Gardener ☐ Govt. Agency ☐ Qualified Applicator Certificate ☐ Private App.

BEEKEEPER NOTIFICATIONS REQUIRED ☐ YES ☐ NO

☐ Spray ☐ Granular ☐ Dust ☐ Fumigation ☐ Bait ☐ Other

RECOMMENDATION ☐ YES ☐ NO ADVISER

OPERATOR OF PROPERTY/OWNER: ALEX ZABIA	LOCATION: 35-26-21	WIND VELOCITY	DIRECTION
COMMODITY (SITE): LOST HILLS AIRSTRIP	ADJACENT ENVIRONMENT (N) (S) (E) (W)		

NAME OF PESTICIDE/PRODUCT	REGISTRATION NUMBER FROM LABEL	CAT.	REST. USE	DOSAGE/CONCENTRATION/VOL.

A. ☐ PRE-APPLICATION SITE INSPECTION

#	COMPLIANCE YES	NO	N/A	Ref. Section	
1				6434	Notice of Intent consistent with permit
2			///	6436	Proper target/pest (logical or expected)
3				6436	Proposed app. complies w/permit conditions
4			///	6436	Environ. cond. consistent w/permit and NOI
5				6436	Written recommendation reviewed
6			///	6556	Adequate methods for need to treat
7	///	///	///		Proposed app. approved ☐ YES ☐ NO
8					
9	///		///	Total	

B. ☐ APPLICATION INSPECTION ☐ AIR ☐ GROUND

#	COMPLIANCE YES	NO	N/A	Ref. Section	
1				11701	Licensed-business/individual-proper cat.
2				11732	Registered in County – Business/Pilot
3				6434	Notice of Intent submitted
4			///	12973	Complies with required labeling
5				14007	Complies with permit conditions
6			///	6600	Suitable methods/equip./manner/climate
7			///	6614	Protect. of nontarget prop./animals/persons
8				11909	Apprentice pilot supervised
9				2477(b)	Employee trained
10				2477(b)	Employee supervised (untrained persons)
11				6404-06	Restricted material use under supervision
12				2477(c)	Medical care posting
13			///	12973	Protective equipment worn
14				2480	Warning signs posted
15				6460-64	Drift cont. req./Phenoxy Herb. Specs.
16					
17	///		///	Total	

C. ☐ FIELD WORKER SAFETY INSPECTION

#	COMPLIANCE YES	NO	N/A	Ref. Section	
1			///	2479(a)	Handwashing facilities
2			///	2479(a)	Field supervisor trained
3			///	2479(c)	Reentry compliance/provisions
4			///	2479(a)	Emergency medical care arrangements
5					
6	///		///	Total	

D. ☐ MIX/LOAD INSPECTION

#	COMPLIANCE YES	NO	N/A	Ref. Section	
1				11701	Licensed/proper cat. business/individual
2				11732	Registered in county
3			///	12973	Complies with required labeling
4				2477(b)	Employee trained
5				2477(b)	Employee supervised (untrained persons)
6			///	12973	Protective equipment worn
7				2478(d)	Closed system used
8				2477(g)	Washing facil./Clothing–Cat. I & II
9				2477(c)	Medical care posting
10			///	6604	Accurate measuring devices
11			///	6670(b)	Containers secured and under control
12				6684	Empty containers rinsed at time of use
13				6404-06	Restricted mat. use under supervision
14	///		///	Total	

E. ☐ EQUIPMENT INSPECTION

#	COMPLIANCE YES	NO	N/A	Ref. Section	
1				11732	Equipment registered in County
2				6630	Equipment identified
3				2478(c)	Sight gauge
4				6606	Adequate agitation
5				6610	Backflow prevention
6				6460	Drift cont. noz. specs.–type/size/angle
7				12859	Service containers labeled
8			///	6600	Equip. in good repair/safe to operate
9					
10	///		///	Total	

F. ☒ PESTICIDE STORAGE SITE INSPECTION

#	COMPLIANCE YES	NO	N/A	Ref. Section	
1	X		///	6672(b)	Locked enclosure
2	X			6674	Storage area posted
3	X			6684	Containers properly rinsed
4	X		///	6676	Pesticides labeled
5	X		///	6680	Pesticides stored in proper containers
6			X	6412	Possession permit for pesticides stored
7					
8	///	0	///	Total	

REMARKS: STORAGE SITE INSPECTION (FOLLOW-UP) AS A RESULT OF INITIAL INSPECTION ON 7-12-90 BY DAVID MOORE. PESTICIDE CONTAINERS ARE PROPERLY STORED.

Signature of Enforcement Officer: Richard White

Acknowledgement of Inspection: Unavailable To Sign

Follow-up Required ☐ YES ☒ NO

Notice of Violation Issued ☐ YES ☐ NO #

The Noncompliance Items Noted Above Are Violations and Must Be Corrected By

Distribution: Original – County 1st Copy – Inspector 2nd Copy – Person/Firm Inspected

REFERENCE 23

906 00022

CONTACT REPORT

AGENCY/AFFILIATION: Kern County Fire Department		
DEPARTMENT:		
ADDRESS: P.O. Box 155	CITY: Lost Hills	
COUNTY: Kern	STATE: CA	ZIP: 93249
CONTACT(S)	TITLE	PHONE
Brian O'Kelly	Captain	(805) 797-2308
BEI PERSON MAKING CONTACT: Jordie Bornstein JB		DATE: 4/8/93
SUBJECT: Fire Department involvement in activities at Lost Hills Airport		
SITE NAME: Farm Flite Ag. Service	EPA ID: CAD 983650078	

DISCUSSION:

The Kern County Fire Department conducts routine fire inspections of the various buildings at the Lost Hills Airport. The inspections primarily consist of a BOK [redacted] check for fire extinguishers and any apparent hazards. The fire department keeps inspection reports on file for approximately 2 years, then destroys them.

Mr. O'Kelly checked their files for the Lost Hills Airport and reported that the file contained inspection reports from 1989 and 1990. In 1989, the inspection report indicated that Farm Flite Ag. Service was operating out of the newer hangar located in the southern portion of the airport. In 1990, an inspection report documented that Farm Flite Ag. Service was no longer in operation and that the buildings were vacant. An additional inspection report from August 1990 indicated that Kaweah Crop Dusters was operating out of the buildings near the runway in the northern portion of the airport.

Mr. O'Kelly personally conducted a number of the fire department inspections and stated that, as far as he knew, no major hazards were reported; he added that the businesses appeared to be operating legitimately and in accordance with fire regulations.

CONTACT CONCURRENCE: Brian O'Kelly DATE: 4-16-93

Geology of the Fresh Ground-Water Basin of the Central Valley, California, with Texture Maps and Sections

By R. W. PAGE

REGIONAL AQUIFER-SYSTEM ANALYSIS

U.S. GEOLOGICAL SURVEY PROFESSIONAL PAPER 1401–C

UNITED STATES GOVERNMENT PRINTING OFFICE, WASHINGTON: 1986

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Dallas L. Peck, *Director*

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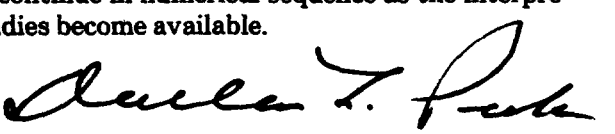
FOREWORD

THE REGIONAL AQUIFER-SYSTEM ANALYSIS PROGRAM

The Regional Aquifer-System Analysis (RASA) Program was started in 1978 following a congressional mandate to develop quantitative appraisals of the major ground-water systems of the United States. The RASA Program represents a systematic effort to study a number of the Nation's most important aquifer systems, which in aggregate underlie much of the country and which represent an important component of the Nation's total water supply. In general, the boundaries of these studies are identified by the hydrologic extent of each system and accordingly transcend the political subdivisions to which investigations have often arbitrarily been limited in the past. The broad objective for each study is to assemble geologic, hydrologic, and geochemical information, to analyze and develop an understanding of the system, and to develop predictive capabilities that will contribute to the effective management of the system. The use of computer simulation is an important element of the RASA studies, both to develop an understanding of the natural, undisturbed hydrologic system and the changes brought about in it by human activities, and to provide a means of predicting the regional effects of future pumping or other stresses.

The final interpretive results of the RASA Program are presented in a series of U.S. Geological Survey Professional Papers that describe the geology, hydrology, and geochemistry of each regional aquifer system. Each study within the RASA Program is assigned a single Professional Paper number, and where the volume of interpretive material warrants, separate topical chapters that consider the principal elements of the investigation may be published. The series of RASA interpretive reports begins with Professional Paper 1400 and thereafter will continue in numerical sequence as the interpretive products of subsequent studies become available.



Dallas L. Peck
Director

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2. Generalized section of geologic units, San Joaquin Valley.

CONVERSION FACTORS

For the readers who may prefer to use the International System of Units (SI) rather than inch-pound units, the conversion factors for the terms used in this report are listed below.

Multiply	By	To obtain
acres	0.4047	(hectares)
feet	0.3048	(meters)
gal/min (gallons per minute)	0.00006309	(cubic meters per second)
inches	25.4	(millimeters)
miles	1.609	(kilometers)
mi^2 (square miles)	2.590	(square kilometers)

GEOLOGY OF THE FRESH GROUND-WATER BASIN OF THE CENTRAL VALLEY, CALIFORNIA, WITH TEXTURE MAPS AND SECTIONS

By R. W. PAGE

ABSTRACT

The Central Valley of California, which is about 400 miles long and averages about 50 miles wide, comprises about 20,000 square miles. Geologically, the valley is a large asymmetric trough that is bounded by granitic, metamorphic, and marine sedimentary rocks of pre-Tertiary age. The trough has been filled with as much as 6 vertical miles of sediment in the San Joaquin Valley and as much as 10 vertical miles of sediment in the Sacramento Valley; these sediments range in age from Jurassic to Holocene.

Some volcanic rocks and deposits crop out in the valley, but of those only the Tuscan Formation in the northeastern part of the Sacramento Valley is of major importance to the fresh ground-water basin.

Post-Eocene continental rocks and deposits contain most of the fresh water in the Central Valley; they crop out virtually over the whole valley and in most places overlie or contain saline water at depth.

Continental rocks and deposits of Tertiary age include the Mehrten Formation. The Mehrten is of great importance to the fresh ground-water basin of the Central Valley and yields large quantities of water to wells.

Although continental rocks and deposits of Tertiary and Quaternary age compose a number of formations and informal deposits, in total they constitute the major aquifer of the Central Valley. In most places, similarity in sediment type between the continental deposits and some underlying rocks and deposits and even between separate units of continental rocks and deposits makes mapping of subsurface geologic contacts difficult if not practically impossible. In this respect, a unit that can be mapped on the surface is difficult to delineate in the subsurface, and, although such a unit can be called an aquifer, it merges with similar units in the subsurface to form a major, widespread aquifer.

Continental rocks and deposits of Tertiary and Quaternary age include (1) the Kern River Formation; (2) the Laguna Formation; (3) the Tulare Formation; (4) the Tehama Formation; and (5) a number of younger formations, as well as some informally named deposits. These deposits and formations also include lacustrine and marsh deposits, which are much thicker and more extensive in the San Joaquin Valley than in the Sacramento Valley. These continental rocks and deposits generally crop out as wide belts along the flanks of the Central Valley and range in thickness from 0 foot along the flanks to about 15,000 feet in the extreme southern part. In general, the rocks and deposits consist of a heterogeneous mixture of generally poorly sorted clay, silt, sand, and gravel; in some places they consist of more consolidated sediments, such as mudstone and sandstone. Yields to wells from these rocks and deposits, except the lacustrine and marsh deposits, range from about 20 gallons per minute to 4,500 gallons per minute.

Lacustrine and marsh deposits crop out in the San Joaquin Valley but not in the Sacramento Valley. Beneath Tulare Lake bed in the San Joaquin Valley, the lacustrine and marsh deposits, which constitute a thick plug of clay and silt from which lenses of clay and silt emanate at irregular intervals, are in places more than 3,600 feet thick. The lens mapped as the E Clay in the San Joaquin Valley is the most extensive lacustrine clay in the entire Central Valley and includes the Corcoran Clay Member of the Tulare Formation. More recent mapping has shown that the E Clay in the extreme southern part of the valley is shallower than previous reports had indicated; therefore, in this report the clay is referred to as the modified E Clay. Perhaps the expansion of lakes and the resulting deposition of extensive clays in the San Joaquin Valley occurred principally because of a large downwarping basin beneath an area known as Tulare Lake bed, and perhaps a similar expansion and deposition did not occur in the Sacramento Valley because a similar downwarping basin probably had not developed there.

Continental deposits of Quaternary age crop out chiefly along the major rivers and streams of the valley as well as other low-lying areas; the deposits include river deposits, flood-basin deposits, and sand dunes. River deposits, including channel and flood-plain deposits, are considered to be the most permeable deposits in the valley; in general, they are not tapped by wells. Flood-basin deposits consist largely of fine-grained beds that restrict the vertical movement of water. Sand dunes are not considered important aquifers because they generally lie above the water table.

The large, asymmetrical, northwestward-trending structural trough of the Central Valley is the principal structure controlling the occurrence and movement of ground water in the area. Because the flanks of the valley are higher than its axis, recharge from tributary rivers and streams has caused heads in the ground water along the flanks to be higher than those along the axis. Therefore, the overall ground-water movement in the Central Valley is from the flanks toward the axis and from there toward the delta area. Secondary structures in the valley, such as arches and faults, also influence the occurrence and movement of ground water.

As it is used in this report, "texture" means the proportion of coarse-grained to fine-grained sediment in sedimentary rocks and deposits. In the Central Valley, most of the deposits for which data are available generally contain no more than 40 to 60 percent of coarse-grained sediment, where coarse-grained sediment includes clayey and silty sand and gravel. Texture columns, maps, and sections, in depth intervals of 300 feet, show that the alluvial deposits of the Central Valley are a heterogeneous mixture whose character ranges over short distances and depths from chiefly fine-grained to chiefly coarse-grained and vice versa. Nevertheless, some areas are underlain chiefly by fine-grained sediment and others by coarse-grained sediment; sediments of like size in an area indicate that sources and depositional environment probably were similar for long periods of time.

INTRODUCTION

This report is the product of the Central Valley aquifer-systems analysis project, which is part of the National Regional Aquifer-System Analysis Program. Several other studies are planned for this project (Bertoldi, 1979, p. 15); a report of the geochemistry of ground water in the valley has been published (Hull, 1984).

PURPOSE AND SCOPE

The purpose of this report is to describe the late Cenozoic subsurface geology of the Central Valley (fig. 1). Such knowledge is necessary for proper management of the ground-water resources of the valley.

The report summarizes and describes those rocks and deposits that are pertinent to the fresh ground-water basin of the Central Valley and shows the relative proportions, both laterally and vertically, of coarse-grained to fine-grained sediments in those rocks and deposits. Thus, this report pertains chiefly to the post-Eocene continental rocks and deposits of the Central Valley with a particular reference to some of their textural features. The investigation did not include any surface mapping of geologic units, so that discussion of geologic units in this report relies chiefly on the work of others.

Older rocks and deposits are discussed as they pertain to the ground-water basin. In addition, some of the general hydrologic properties of both the older and younger rocks and deposits are discussed.

LOCATION AND GENERAL FEATURES

The Central Valley comprises about 20,000 mi^2 and extends from near Red Bluff on the north to near Bakersfield on the south, a distance of about 400 miles (fig. 1). The average width of the valley is about 50 miles, and the valley is bounded on the north by low-lying hills; on the northeast by a volcanic plateau of the Cascade Range; on the west by the Coast Ranges, which in places rise to altitudes of about 4,000 feet; on the east by the Sierra Nevada, which in places rise to altitudes of more than 14,000 feet; and on the south by the Coast Ranges and the Tehachapi Mountains (figs. 1 and 2). Roughly the northern one-third of the valley is known as the Sacramento Valley and the southern two-thirds as the San Joaquin Valley.

Mean annual precipitation in the Sacramento Valley ranges from about 25 inches along the flanks to about 14 inches near Sutter Buttes (Rantz, 1969). Mean annual precipitation in the San Joaquin Valley ranges from about 15 inches along the eastern flank of the valley to about 5 inches just west of Bakersfield. Mean annual precipitation in the Sierra Nevada is significantly higher, and some areas in the northern part average 90 inches (Rantz, 1969). Most of the precipitation in the Central Valley falls from late autumn through early spring. Hot and dry summers and cool and moist winters are the norm in the valley.

The Sacramento River flows southward through the Sacramento Valley to join the San Joaquin River in the delta area east of Suisun Bay (fig. 2). Major tributaries of the Sacramento River, including the Feather River, flow westward from the Sierra Nevada; smaller tributaries flow eastward from the Coast Ranges. The San Joaquin River enters the San Joaquin Valley just northeast of Fresno, and it flows westward before turning northward to join the Sacramento River in the delta area. All the major tributaries of the San Joaquin River originate in the Sierra Nevada (fig. 2). Farther south, the Kern River enters the San Joaquin Valley from the Sierra Nevada.

Just south of Fresno is an area of interior drainage dominated by the low-lying Tulare Lake bed; Buena Vista and Kern Lake beds are also part of this area. Because Tulare Lake bed is the largest bed in the area and lies at the lowest altitude, about 180 feet, the whole area is commonly referred to as the Tulare Lake drainage basin. In some wet years, water fills the Tulare Lake bed and spills northward toward the San Joaquin River.

Within the Central Valley the most extensive geomorphic units include (1) dissected uplands, (2) low alluvial plains and fans, (3) river flood plains and channels, and (4) overflow lands and lake bottoms (fig. 2) (Davis and others, 1959, pl. 1; Olmsted and Davis, 1961, pl. 1). The most prominent geomorphic unit is Sutter Buttes.

Dissected uplands lie along the flanks of the valley near the borders of the mountains. They commonly show forms characteristic of alluvial fans but range in form from dissected hills where relief is several hundred feet to gently rolling lands where relief is only a few feet.

Low alluvial plains and fans, which constitute the belt of coalescing alluvial fans of low relief between the dissected uplands and the valley trough, range in relief from nearly flat to slightly dissected where they merge with the dissected uplands.

River flood plains and channels lie along the trunk streams and their major tributaries (fig. 2). Some of the tributary rivers are incised below the general land surface and have well-defined flood plains; in the axial trough of the valley, the rivers are flanked by low-lying overflow lands, and natural levees confine the flood-plain and channel deposits to stream channels.

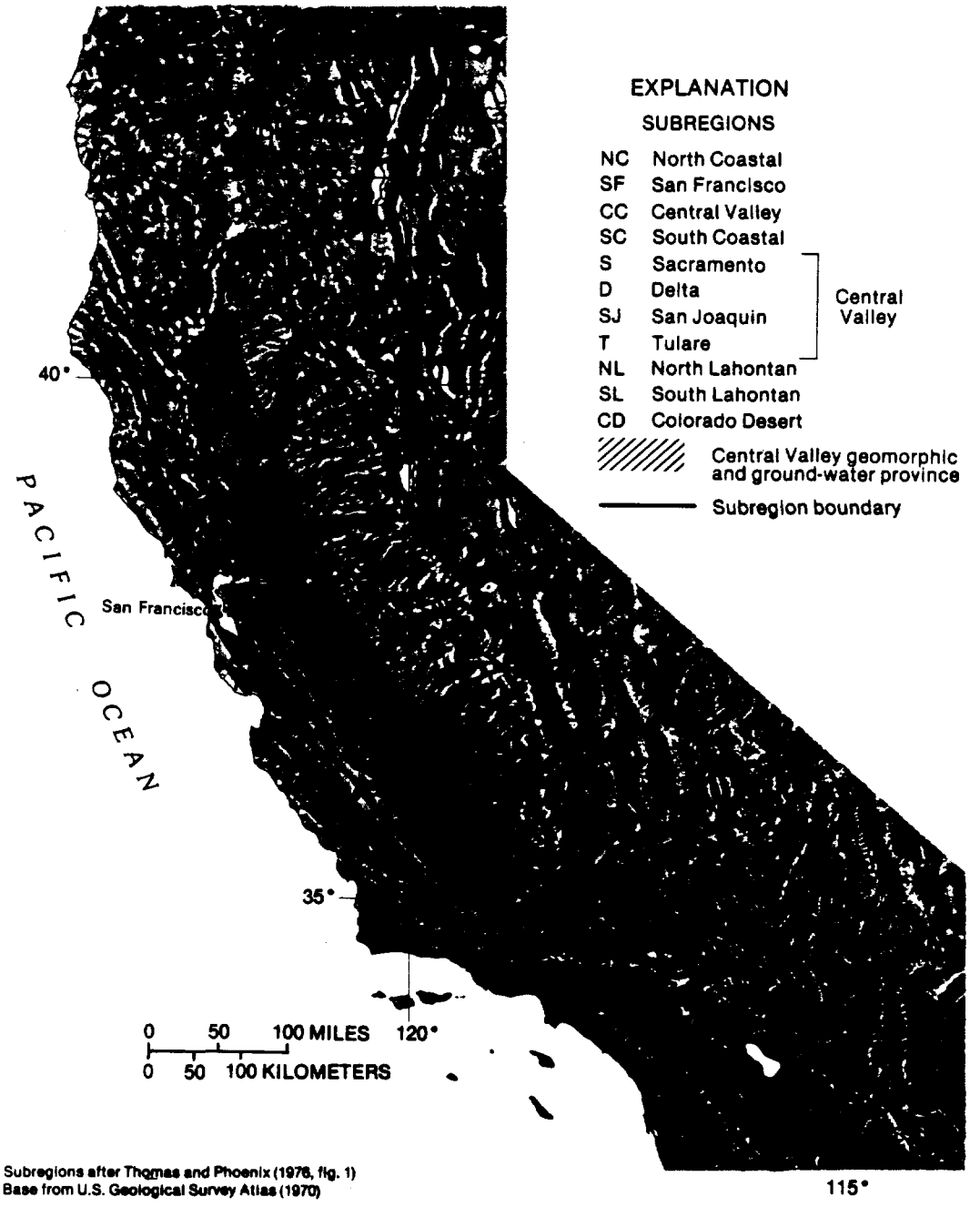

Figure 1. Subregions and landforms of California and adjacent areas.

Overflow lands and lake bottoms include Buena Vista, Kern, and Tulare Lake beds. They are characterized by very gentle slopes of the land surface, and during times of highest flooding they are wholly or partly inundated.

The volcanic Sutter Buttes, which seem to burst from the plain of the Sacramento Valley, are a small mountain range of sharp relief that is about 10 miles in diameter and about 2,000 feet in altitude.

PREVIOUS REPORTS

Mendenhall and others (1916) wrote the first comprehensive report on ground water in the San Joaquin Valley, which included a brief discussion of the geology of the valley and the surrounding mountains and a discussion of the origin of land forms.

Bryan (1923) wrote the first comprehensive report on geology and ground water in the Sacramento Val-

ley. He discussed the geology of the valley and its relation to the occurrence of ground water and yield to wells. He also discussed land forms.

Forbes (1931) discussed the geology and groundwater storage capacity of the San Joaquin Valley but did not include a geologic map.

Hoots and others (1954) wrote a geological summary of the San Joaquin Valley. The report discusses the structure and general stratigraphy of the valley. The report also includes eight paleogeographic maps that show the distribution and thickness of sediments ranging in age from Paleocene to Pleistocene.

Davis and others (1959) wrote a comprehensive report on the geology, geomorphology, and ground water of the San Joaquin Valley; they did not include a geologic map but did discuss the geologic history of the San Joaquin Valley in some detail. They also discussed the occurrence of a diatomaceous clay that underlies a large part of the San Joaquin Valley.

Repenning (1960) discussed the general stratigraphy of the Central Valley, and in his report included a map showing the thickness of sedimentary rocks in the valley and seven maps showing the distribution and thickness of sediments ranging in age from Paleocene to Pleistocene.

Olmsted and Davis (1961) wrote a comprehensive report on the geology, geomorphology, ground water, and geologic history of the Sacramento Valley. The geologic map included in their report is considered to be the best reference for the Sacramento Valley on geology pertaining to ground water.

Hackel (1966) described the general stratigraphy and structure of the Central Valley and included Repenning's maps in his report.

Croft (1972) mapped the subsurface geology of the upper Tertiary and Quaternary water-bearing deposits of the southern part of the San Joaquin Valley. He also mapped three extensive clays that function as confining beds.

Redwine (1972) discussed the subsurface geology of the Sacramento Valley and mapped geologic units on six cross sections. His discussion of some of the stratigraphic units occurring in the subsurface of the Sacramento Valley is extensive.

Page (1974) mapped the base and thickness of the post-Eocene continental deposits in the Sacramento Valley. Included in his report is a structure-contour map of the base of those deposits.

The California Department of Water Resources (1978) wrote another comprehensive report on the geology, geomorphology, and ground water of the Sacramento Valley. That report includes a discussion of soils and of geologic structures that affect the movement of ground water.

Harwood and Helley (1982) mapped the major late Cenozoic structural features and depth to the basement of the Sacramento Valley.

Numerous other reports also have been written concerning the geology of local areas in the Central Valley, including a number of recently published maps and reports. Many of those reports are listed under "Selected References".

WELL-NUMBERING SYSTEM

Wells are identified according to their location in the rectangular system for the subdivision of public lands. For example, in the number 12N/1E-34Q1, the part of the number preceding the slash indicates the township (T. 12 N.); the number after the slash, the range (R. 1 E.); the digits after the hyphen, the section (sec. 34); and the letter after the section number, the 40-acre subdivision of the section, as indicated on the diagram below.

D	C	B	A
E	F	G	H
M	L	K	J
N	P	Q	R

Within each 40-acre tract the wells are numbered serially as indicated by the final digit of the well number. For example, well 12N/1E-34Q1 was the first well to be listed in the SW¼SE¼ sec. 34. The final digit has been omitted for wells not field located by the Geological Survey.

Most of the study area lies north or south and east or west of the Mount Diablo base line and meridian (M). A small area at the southern part of the valley lies north and west of the San Bernardino base line and meridian (S), but no wells in the study area are referred to this base line.

GEOLOGY

The Central Valley is a large, northwestward-trending, asymmetric structural trough that has been filled with as much as 6 vertical miles of sediment in the San Joaquin Valley and as much as 10 miles of sediment in the Sacramento Valley; these sediments range in age from Jurassic to Holocene and include both marine and continental rocks and deposits (fig. 3) (Repenning, 1960, p. 7, fig. 2). The sediments beneath part of the eastern side of the valley are underlain by

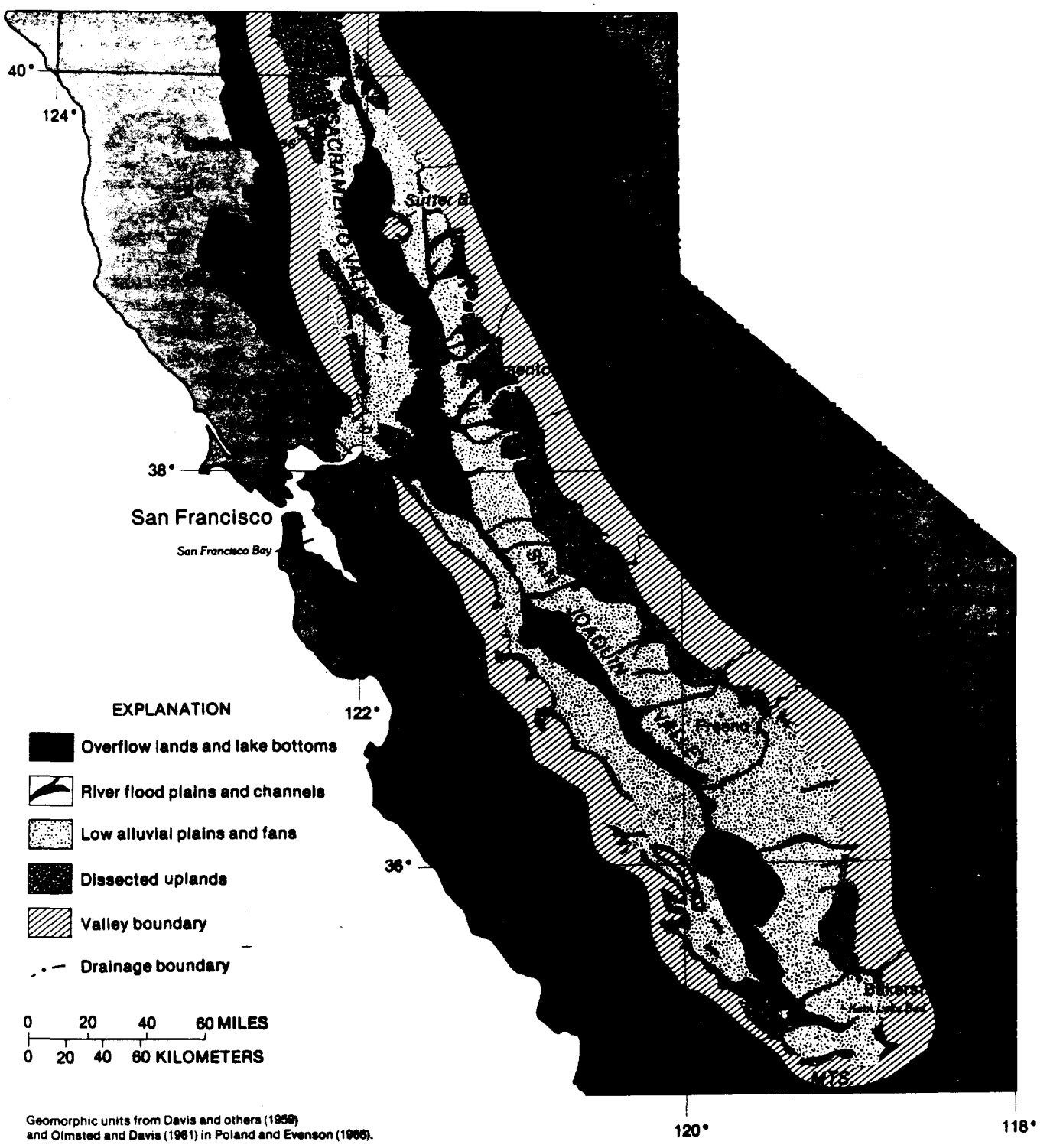

Figure 2. Geomorphic map of Central Valley.

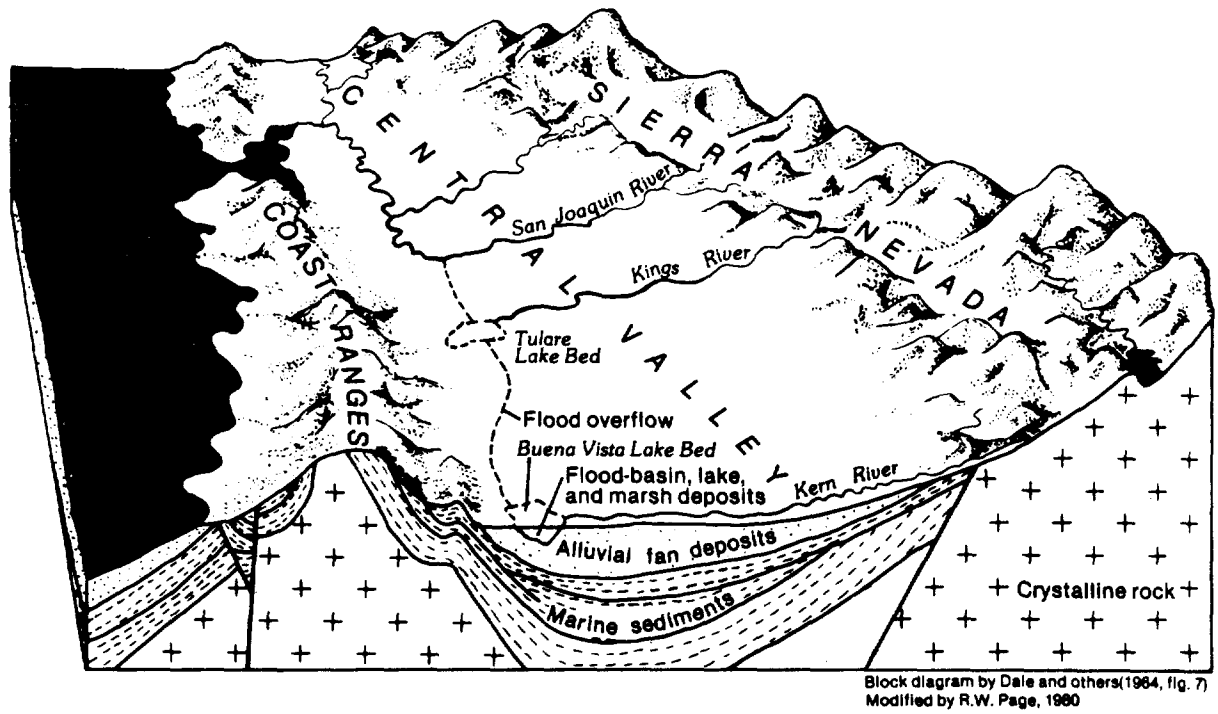

Figure 3. Generalized geologic section and view of part of the Central Valley.

granitic and metamorphic rocks of pre-Tertiary age. Beneath the western side and part of the eastern side, the sediments are thought to be underlain by a mafic and ultramafic complex of pre-Tertiary age (Cady, 1975, p. 17-19; and Suppe, 1978, p. 7). Granitic and metamorphic rocks crop out along most of the eastern and southeastern flank of the Central Valley (pls. 1 and 2). Marine rocks of pre-Tertiary age crop out along most of the western flank of the valley, and marine rocks and deposits of Tertiary age crop out around Sutter Buttes and along the western, southwestern, southern, and southeastern flanks of the valley (pls. 1 and 2). Volcanic rocks and deposits of Pliocene age crop out along the northeastern flank (pl. 1).

The post-Eocene continental rocks and deposits contain most of the fresh ground water in the Central Valley and crop out over virtually the whole valley (pls. 1 and 2, tables 1 and 2). In most places, the continental rocks and deposits overlie or contain saline water at depth (Berkstresser, 1973; Page, 1973); saline water, as defined here, has a minimum dissolved-solids concentration of 2,000 mg/L.

GRANITIC AND METAMORPHIC ROCKS (PRE-TERTIARY)

The granitic and metamorphic rocks crop out mostly along the eastern flank of the valley (pls. 1 and 2). In places, some mafic intrusive rocks are included with the granitic rocks. Metamorphic rocks contain metasedimentary, metavolcanic, and undifferentiated-metamorphic rocks. These rocks form an almost impermeable boundary for the ground-water basin, but fractures and joints permit small yields of water to wells. The granitic and metamorphic rocks slope gently southwestward from the outcrops in the Sierra Nevada to depths of more than 15,000 feet in the Central Valley (Smith, 1964).

MARINE ROCKS (PRE-TERTIARY)

Marine rocks of pre-Tertiary age crop out mostly along the western flank of the valley, although some marine rocks crop out along the eastern flank, and a small outcrop occurs in Sutter Buttes where the marine rocks were intruded by a volcanic plug (pls. 1-3). The marine rocks are composed mostly of conglomerate, sandstone, siltstone, mudstone, and shale. Where saturated, these rocks generally contain saline water and would yield only small quantities of water to wells.

Beneath the north-central part of the valley, the marine rocks, together with some lower Tertiary rocks, lie at depths of more than 1,500 feet, and from north to south they lie at generally ever greater depths and thus define the southerly tilt of the Central Valley (pls. 1-3) (Ross and McCulloch, 1979; Suppe, 1978). Marine rocks of Cretaceous age are as much as 25,000 feet

thick in the Sacramento Valley, and in the San Joaquin Valley they are as much as 20,000 feet thick (Repenning, 1960, p. 10, fig. 4).

MARINE ROCKS AND DEPOSITS (TERTIARY)

Near the close of the Late Cretaceous, tectonic movements elevated many Coast Range areas, including those adjacent to the Sacramento Valley and the northern San Joaquin Valley; these movements created the ancestral Tertiary San Juaquin and Sacramento basins as restricted troughs of deposition lying between the emerging Coast Ranges and the eastern Sierra Nevada (Hackel, 1966, p. 223). Both marine and continental rocks and deposits, ranging in age from Paleocene to Pliocene, were deposited into these continually evolving basins. As indicated by Repenning (1960, figs. 5-11), marine rocks and deposits were dominant in the Central Valley from the Paleocene to the beginning of the Miocene; during the early Miocene, marine rocks were restricted to the southern part of the San Joaquin Valley; during the middle Miocene, marine rocks and deposits were still restricted to the southern part of the San Joaquin Valley except near Suisun Bay; during the late Miocene, marine rocks and deposits were laid down around Suisun Bay along the western flank of the San Joaquin Valley and throughout most of the southern part of the valley; and, by Pliocene time, marine rocks and deposits were again restricted to the southern part of the San Joaquin Valley. During the Pleistocene and Holocene, the seas had retreated, and only continental rocks and deposits were being laid down.

Marine rocks and deposits of Tertiary age, therefore, underlie large parts of the Central Valley; they crop out around Sutter Buttes and along the southwestern flank of the Sacramento Valley as well as along the western, southwestern, southern, and southeastern flanks of the San Joaquin Valley (pls. 1 and 2).

Because of their varied history of deposition, the marine rocks and deposits differ greatly in sediment type, sorting, and thickness, and they have been given many names by petroleum geologists (Sacramento Petroleum Association, 1962, figs. 6, 7, 10, 20, and 27, table 2; Park and Weddle, 1959, pl. 3). The marine rocks and deposits were, in part, the source rocks for some of the deposits in the fresh ground-water basin; some of the saline water they contain has migrated into adjacent and overlying continental deposits (pl. 3).

In a few places in the San Joaquin Valley, however, the marine rocks and deposits have been flushed of saline water, and they now contain fresh water, which they yield to wells. In the Sacramento Valley, marine rocks and deposits have not been reported as yielding fresh water to wells, although Olmsted and Davis (1961, p. 134) said that locally marine rocks have been flushed of connate water.

Hilton and others (1961, p. 28, table 3) reported that the Vedder Sand, the overlying Pyramid Hill Sand Member of the Jewett Sand, and the Olcese Sand, which overlies the Pyramid Hill Sand Member, were potential sources of fresh ground water in the Richgrove area along the southeastern flank of the San Joaquin Valley (pl. 2, table 2). In this report area, the Vedder Sand of Oligocene age (Bartow, J. A., and McDougall, K. A., U.S. Geological Survey, written commun., 1982) and the overlying Pyramid Hill Sand Member of the Jewett Sand of Miocene age consist, in aggregate, of (1) a lower bed of alternating fine-grained marine sand and nonmarine gritty sand and gravel and (2) an upper bed of olive-brown, very clayey sand with black pebbles at the base (Hilton and others, 1961, table 3). The Vedder Sand in this area is described as being partly nonmarine (Albright and others, 1957, table 3). These sands range in thickness from 0 to about 300 feet. The Vedder Sand and the Pyramid Hill Sand Member of the Jewett Sand are separated from the Olcese Sand by the Freeman Silt of Miocene age. This silt consists of a hard, compact siltstone and silty sand, and in the Richgrove area it ranges in thickness from 0 to about 1,100 feet (Hilton and others, 1961, table 3). The Olcese Sand of Miocene age consists of unconsolidated medium- to coarse-grained sand containing few pebble and siltstone beds; it crops out near Poso Creek and ranges in thickness from 0 to about 600 feet. In the Richgrove area, the Round Mountain Silt of Miocene age overlies the Olcese Sand. The Round Mountain Silt consists mostly of a firm gray and brown siltstone that contains beds of diatomite and silty sand (Hilton and others, 1961, table 3; Albright and others, 1957, table 1). In the Richgrove area, this silt ranges in thickness from 0 to about 200 feet.

Overlying the Round Mountain Silt is the Santa Margarita Formation of Diepenbrock (1933) of Miocene age as used by Hilton and others (1961), which in the Richgrove area is a major aquifer that reportedly yields as much as 1,950 gal/min to wells (Hilton and others, 1961, p. 51). Croft (1972, p. 13) reported that the formation also yields water to wells in the foothills southeast of Bakersfield, where it has been mapped as the Santa Margarita Formation of Hoots (1930) (Bartow and Doukas, 1978). In the Richgrove area, the formation, which ranges in thickness from 0 to about 600 feet (Hilton and others, 1961, table 3), consists of an upper bed of fine, silty, fairly well-sorted to well sorted gray sand and a lower bed of brownish-gray and brown fossiliferous micaceous sandy siltstone.

All marine beds in this area thicken and dip gently in a westerly direction (Lofgren and Klausing, 1969, figs. 4 and 5).

CONTINENTAL AND MARINE ROCKS AND DEPOSITS (TERTIARY)

During the time of deposition of marine sediments of Tertiary age in the Central Valley, continental rocks and deposits also were laid down. As the seas advanced and retreated, some rocks and deposits became a mix of both continental and marine sediments. In general, these types of rocks and deposits are not important to the fresh ground-water basin of the Central Valley, but locally in the San Joaquin Valley some of them yield large quantities of fresh water to wells.

As mentioned in the previous section, the Vedder Sand contains some continental and marine sediments that are potential sources of water along the southeastern flank of the San Joaquin Valley. On the northwestern side of the San Joaquin Valley in the Tracy-Dos Palos area (pl. 2), a few wells reportedly yield fresh water from the upper part of the San Pablo Formation or Group of Miocene age (Hotchkiss and Balding, 1971, p. 15). The San Pablo Formation, which unconformably overlies the marine Kreyenhagen Formation of Eocene age, consists of volcanic gravel, sand, and clay. Much of the San Pablo in the northwestern part of the valley was deposited in a fresh water or subaerial environment; locally, marine fossils are found in the formation (Miller and others, 1971, p. 13). Farther south in the Los Banos-Kettleman City area, the Etchegoin Formation of Miocene and Pliocene age and the overlying San Joaquin Formation of Pliocene age are also partly continental and partly marine. Both of these formations crop out along the hills in the area and dip gently northeastward beneath the valley (pl. 2, table 2). Miller and others (1971) made a detailed study of the geology in the area, and the following discussion is based largely on their work.

The sediment type of the Etchegoin Formation varies considerably, ranging from clay and silt to sand, gravel, and sandstone. It ranges in thickness from a few tens of feet to more than 2,000 feet. Further, marine fossils in the formation are more abundant in the southern part of the Los Banos-Kettleman City area than in the northern part. Several wells near the foothills and a few deep wells in the valley derive fresh water from the Etchegoin; however, its depth of more than 3,000 feet beneath most of the valley prevents it from being considered an important source of water.

The San Joaquin Formation also has different sediment types, but much of it contains silt and silty sandstone; in the Kettleman Hills, a basal conglomerate is part of the formation. In the deep subsurface of the valley northeast of the Kettleman Hills, the deposits are considered a shoreline phase of the San Joaquin Formation. The formation there is coarser and more permeable than in the Kettleman Hills and yields fresh water to many wells. Southeast of the area in T. 23 S., Rs. 21 and 22 E., at depths of about 2,700 feet, the San Joaquin Formation is considered marine rather than a mix of continental and marine sediments (Hill, 1964a, b). The San Joaquin is the youngest formation in the Central Valley that contains deposits of marine origin.

VOLCANIC ROCKS AND DEPOSITS

In the Sacramento Valley, volcanic rocks and deposits of Miocene and Pliocene age (table 1) crop out in the northeastern and western parts (pl. 1), and volcanic rocks and deposits of Pliocene and Pleistocene age (table 1) crop out around Sutter Buttes. In the San Joaquin Valley, volcanic rocks of Miocene and Pliocene age (table 2) crop out in the northeastern and southern parts (pl. 2).

The volcanic rocks and deposits around Sutter Buttes are similar to both the Mehrten Formation of Miocene to late Pliocene age (see "Mehrten Formation") and the Tuscan Formation of Pliocene age; they are locally important sources of water (California Department of Water Resources, 1978, p. 21). These rocks and deposits are not discussed further in the present report. Of all the other volcanic rocks and deposits, only the Tuscan Formation in the northeastern part of the Sacramento Valley is of major importance to the fresh ground-water basin of the Central Valley.

TUSCAN FORMATION

The Tuscan Formation crops out virtually continuously from northeast of Red Bluff to just north of Oroville (pl. 1, table 1). Harwood and others (1981) mapped the Tuscan in the northeastern part of the Sacramento Valley. Furthermore, Olmsted and Davis (1961, p. 67-72) and the California Department of Water Resources (1978, p. 22-25) discussed the Tuscan in detail with respect to ground water, and the following discussion is based largely on their work.

The major part of the Tuscan Formation lies east of the Sacramento Valley beneath a volcanic plateau of the Cascade Range. West of the Chico monocline, the formation continues to dip southwestward and underlies the Sacramento Valley, where it extends in the subsurface to a distance of about 5 miles west of the Sacramento River. Throughout much of the subsurface in this part of the valley, the Tuscan is separated from marine rocks by a dense, impervious basalt flow (Ellsworth, 1948). Unlike most other rocks and deposits on the eastern side of the valley, the Tuscan Formation thins from east to west; in the Cascade Range its

maximum thickness is about 1,600 feet (Lydon, 1969), and beneath the valley it thins to about 300 feet; west of the Chico Monocline it is about 1,000 feet thick (California Department of Water Resources, 1978, table 1). There, the Tuscan consists largely of black volcanic sand, gravel, and tuffaceous clay, which probably were derived from beds of tuff breccia reworked by streams. Some beds of tuff breccia underlie the valley at distances of 5 to 10 miles from the outcrop of the Tuscan.

The Tuscan Formation yields large quantities of fresh water to wells; reported yields range from 900 gal/min to more than 3,000 gal/min (California Department of Water Resources, 1978, p. 25; Olmsted and Davis, 1961, p. 72). Because the Tuscan contains beds of clay and tuff breccia, most ground water in the Tuscan is confined (California Department of Water Resources, 1978, p. 25).

CONTINENTAL ROCKS AND DEPOSITS

From the Paleocene through the Oligocene, continental rocks and deposits were restricted chiefly to the northern, eastern, and southeastern parts of the Central Valley; during the early and middle Miocene, continental rocks and deposits occupied most of the valley north of Fresno as well as narrow belts along the southeastern and southern parts of the San Joaquin Valley (Repenning, 1960, figs. 5-8). During the late Miocene, continental rocks and deposits occupied the central and eastern parts of the valley north of Merced and a narrow belt along the eastern side of the valley from Merced to just south of Fresno; they also occupied an area on the western side of the valley opposite Fresno and part of the southeastern San Joaquin Valley (Repenning, 1960, fig. 10). By Pliocene time, continental rocks and deposits occupied all of the Sacramento Valley and most of the northern part of the San Joaquin Valley, as well as wide belts along its eastern and southern parts (Repenning, 1960, fig. 10). After the Pliocene, only continental rocks and sediments were deposited in the valley. Further, after a major uplift of the surrounding area during the middle Pleistocene, the valley evolved to its present-day form, which has contributed to erosion of many of the older rocks and deposits and a more restricted area of deposition for the younger deposits.

The older continental rocks and deposits crop out along the flanks of the Central Valley, and the younger deposits crop out along streams and along the flanks and throughout the rest of the valley (pls. 1 and 2).

Because of their depositional history, these rocks and deposits also differ greatly in sediment type, sorting, and thickness. The types of deposit include alluvial fan, deltaic, flood basin, lacustrine, marsh, and river, as well as sand dunes. In places, volcanic rocks and deposits of Tertiary age are associated with the continental rocks and deposits. The continental rocks and deposits range in thickness from 0 foot along the flanks of the valley to more than 15,000 feet just north of Wheeler Ridge in the southern part of the San Joaquin Valley. There, rapid downwarping contributed to this very thick section of post-middle Pliocene continental rocks and deposits (de Laveaga, 1952, p. 102). In this part of the valley, however, the base of fresh water lies at a maximum depth of about 4,700 feet (Page, 1973); this is therefore the thickest section that contains fresh water in the Central Valley.

CONTINENTAL ROCKS AND DEPOSITS (TERTIARY)

This part of the report includes a discussion of (1) four units of continental rocks and deposits of Tertiary age in the Sacramento Valley and (2) four units in the San Joaquin Valley. The units are grouped by age and some lithologic similarity; some units include more than one formation or informal unit. Symbols of map units (pls. 1 and 2) are included for clarity.

One of the units, continental rocks and deposits of uncertain age (Tcu), occurs only in the Sacramento Valley, and one, continental rocks and deposits of Eocene to Miocene(?) age (Tcme), occurs only in the San Joaquin Valley (pls. 1 and 2). Three of the units of continental rocks and deposits in the Sacramento Valley are also present in the San Joaquin Valley; they are (1) of Eocene age (Tce), (2) of Oligocene and Miocene age (Tcmo), and (3) of Miocene and Pliocene age (Tcpm) (pls. 1 and 2; tables 1 and 2).

Older Tertiary continental rocks and deposits yield some water to wells, but they are not important to the fresh ground-water basin of the Central Valley. On the other hand, some of the younger Tertiary rocks and deposits yield large quantities of ground water to wells.

Some of the older continental rocks and deposits of Tertiary age are not of great importance to the fresh ground-water basin of the Central Valley because they contain saline water, or the nature of their sediments prevents large yields to wells, or both. Included in this group are the Ione Formation of Eocene age (Tce) and the Valley Springs Formation of Oligocene and Miocene age (Tcmo). The Oligocene and Miocene age of the Valley Springs is based on the work of Marchand and Allwardt (1981, p. 10). Brief discussions of these formations are included herein.

Other Tertiary continental rocks and deposits are generally of such limited extent that they are not of great importance to the ground-water basin and are

therefore not discussed further in this report; these include, for example, the continental rocks and deposits of uncertain age (Tcu) in the eastern part of the Sacramento Valley and the Bena Gravels of Miocene age (Tcmo) in the southern part of the San Joaquin Valley. Also omitted from discussion are rocks and deposits that generally are not penetrated by water wells, lie at extreme depths, and at depth contain saline water—such as the Walker Formation of late Eocene through early Miocene age (Tcme) and the Zilch formation of informal subsurface usage, which is considered to be the widespread continental equivalent of the Temblor Formation of Oligocene and Miocene age (Tm) (Hunter, 1952, p. 21; Repenning, 1960, fig. 8). The Chanac Formation of Miocene age (Tcpm) (Bartow, J. A., and McDougall, K. A., written commun., 1982) probably belongs in this group, too, because it is reportedly penetrated only by oil wells in the subsurface of the southern San Joaquin Valley (Wood and Dale, 1964, p. 37).

On the other hand, the Mehrten Formation of Miocene to late Pliocene age (Tcpm) is a unit of continental rocks and deposits of Tertiary age that is of great importance to the fresh ground-water basin of the Central Valley.

Ione Formation

The Ione Formation crops out discontinuously along the eastern flank of the valley from just south of Chico to just north of Fresno (pls. 1 and 2, tables 1 and 2). In most areas of outcrop, it lies unconformably on pre-Tertiary rocks and dips gently southwestward beneath the Central Valley. The Ione is composed of clay, sand, sandstone, and conglomerate. Where exposed, it ranges in thickness from 0 to about 400 feet in the Sacramento Valley and from 0 to 200 feet in the San Joaquin Valley (California Department of Water Resources, 1978, p. 20; Davis and Hall, 1959, p. 8). Allen (1929) considered it largely deltaic in origin; Piper and others (1939, p. 84) considered it largely fluviatile with some lacustrine and lagoonal deposits. Large parts of the Ione, however, were considered marine by Redwine (1972, p. 100-104). Because of the clay and consolidated rocks, the Ione Formation yields only small quantities of water to wells, and in places it reportedly yields saline water (California Department of Water Resources, 1978, p. 21; Davis and Hall, 1959, p. 8).

Valley Springs Formation

The Valley Springs Formation crops out discontinuously along the eastern flank of the valley from just south of the Bear River to just north of the Chowchilla River (pls. 1 and 2, tables 1 and 2). In most areas, the formation lies unconformably over the Ione Formation or the pre-Tertiary rocks and dips gently southwestward beneath the valley. The Valley Springs is a mostly fluvial sequence of chiefly sandy clay, quartz sand, rhyolitic ash, and siliceous gravel (Davis and Hall, 1959, p. 8-9); east of Modesto the Valley Springs was believed by Page and Balding (1973, p. 17) and the U.S. Bureau of Reclamation (written commun., 1958 and 1959) to be composed chiefly of rhyolitic tuff and some siltstone and claystone. Bartow (1982) considered the Valley Springs to have been deposited on a poorly drained coastal plain that was occasionally blanketed by ash deposits. Where exposed or where recorded on well logs, the Valley Springs ranges in thickness from 0 to about 200 feet in the Sacramento Valley and from 0 to about 450 feet in the San Joaquin Valley (California Department of Water Resources, 1978, p. 78; Piper and others, 1939, p. 77).

Because of its fine ash and clay matrix, the Valley Springs is generally a small-yield aquifer, although one well in the Modesto area yielded 710 gal/min (Page and Balding, 1973, p. 17).

Mehrten Formation

The Mehrten Formation crops out discontinuously along the eastern flank of the valley from just south of the Bear River to just south of the Chowchilla River (pls. 1 and 2; tables 1 and 2). It overlies the Valley Springs Formation and in places lies uncomformably on pre-Tertiary rocks (pls. 1 and 2). The Mehrten dips gently southwestward beneath the valley, and there it is considered to interfinger with marine and nonmarine facies of the Neroly Formation of Miocene age (Davis and Hall, 1959, p. 10).

Piper and others (1939, p. 61-71) were the first to describe the Mehrten Formation; they designated its type section as being in the NE¼ SW¼ sec. 5, T. 4 N., R. 9 E. There, the Mehrten is composed of about 190 feet of clay and silt and andesitic sandstone and breccia (Piper and others, 1939, p. 62).

In the Sacramento Valley, the Mehrten can be divided into two units: (1) an overlying unit composed mostly of unconsolidated black sands interbedded with blue-to-brown clay and (2) an underlying unit of hard, very dense tuff breccia (California Department of Water Resources, 1978, p. 21). Where exposed in the Sacramento Valley, the Mehrten is as much as 200 feet thick, and in the subsurface it ranges in thickness from 400 to 500 feet. In the northeastern part of the San Joaquin Valley, Davis and Hall (1959, p. 10) divided the Mehrten into three units: a lower unit of scoria-

ceous and pumiceous sand and conglomerate that has a maximum thickness of about 40 feet where exposed; a middle unit of alternating andesitic gravel, sand, and silt that has an estimated thickness of about 400 feet where exposed; and an upper unit of soft clay, silt, sand, and minor amounts of gravel that has an aggregate thickness of about 300 feet where exposed. Further, they indicated that the Mehrten attains a maximum thickness of about 1,200 feet in the western part of the Modesto area where it lies at a depth of about 1,100 feet (Davis and Hall, 1959, pl. 3). There, however, the Mehrten contains saline water (Page and Balding, 1973, fig. 6). Marchand and Allwardt (1981, p. 10) stated that the Mehrten in the Modesto-Merced area consists of claystone, siltstone, sandstone, and conglomerate; they also observed a general decrease in mean grain size in the Mehrten from the Stanislaus River on the north to near the Fresno River on the south. The Mehrten Formation is considered to have been laid down by streams carrying andesitic debris from the Sierra Nevada (Marchand and Allwardt, 1981, p. 10).

Generally, the Mehrten Formation yields large quantities of water to wells, although hydraulic conductivity in the Mehrten varies from place to place (Page and Balding, 1973, p. 22). Ground water in the Mehrten is probably confined in places by consolidated rocks.

CONTINENTAL ROCKS AND DEPOSITS (TERTIARY AND QUATERNARY)

Although continental rocks and deposits of Tertiary and Quaternary age (tables 1 and 2) constitute a number of formations and informal units, in total they compose the major aquifer in the Central Valley, and in general consolidated sediments are fewer than in the Tertiary continental rocks and deposits. For example, Croft (1972, p. 13) said that in the San Joaquin Valley a gradational change probably occurs between the consolidated rocks and the overlying, unconsolidated deposits.

In most places in the Central Valley, the similarity in sediment type of the continental rocks and deposits of Tertiary and Quaternary age and some underlying rocks and deposits, and even between separate units of continental rocks and deposits, makes mapping of subsurface contacts with any degree of certainty difficult if not practically impossible. In this respect, a unit that can be mapped on the subsurface is difficult to delineate in the subsurface, and although in the Central Valley such a unit can be considered a separate aquifer, in the subsurface it merges with similar units to form a major widespread aquifer. In places, this aquifer is separated by confining beds (see "Lacustrine and Marsh Deposits"), and there ground water occurs under both unconfined and confined conditions.

Dale and others (1966, p. 21) in their report on the Kern River area indicated that, although units of continental rocks and deposits could be differentiated and mapped on the surface by using physiographic and weathering criteria, the subsurface equivalents of these units could not be mapped because there was no apparent difference in lithology. Furthermore, E. J. Helley of the U.S. Geological Survey (oral commun., 1982) said that new geologic maps of the valley differ significantly from the old maps because of recent dating of tuffs and new mapping of the continental rocks and deposits in the Central Valley; subsurface equivalents of these newly mapped units, however, are still difficult to determine. Some of these new maps are available (see "Previous Reports").

For this report, continental rocks and deposits of Tertiary and Quaternary age and some of the deposits of Quaternary age have been grouped as the continental rocks and deposits of Tertiary and Quaternary age (QTc) (pls. 1 and 2; tables 1 and 2). They are discussed as a group because (1) some of the new maps, correlations, and interpretations are not yet available; (2) subsurface contacts between units of the group are difficult to determine; and (3) they compose in total the major, widespread aquifer of the Central Valley. Lacustrine and marsh deposits are discussed separately in this report.

The continental rocks and deposits of Tertiary and Quaternary age crop out virtually continuously along the flanks of the Central Valley and dip gently toward the valley trough (pls. 1 and 2). They include the Kern River Formation of Miocene to Pleistocene(?) age, which crops out in the Bakersfield area; the Laguna Formation of Pliocene age, as mapped by Marchand and Allwardt (1981, p. 19, pl. 1); the Tulare Formation of Pliocene and Pleistocene age, which crops out along the western part of the San Joaquin Valley; the Tehama Formation[1] of Pliocene to Pleistocene age (Page and Bertoldi, 1983, p. 17), which crops out along the western and northwestern part of the Sacramento Valley; and the Red Bluff Formation of Pleistocene age, which crops out in the Sacramento Valley. They also include the Turlock Lake Formation, the Riverbank Formation, and the Modesto Formation, all of Pleistocene age, which crop out in both the Sacramento and San Joaquin Valleys. In addition, they include informal units, such as continental deposits of Tertiary and Quaternary age, older alluvium of Pleistocene and Holocene(?) age, and probably younger alluvium of Holocene age. These informal units undoubtedly contain some of the formal units that already have been mentioned.

[1] The Pliocene and Pleistocene age of the Tehama Formation as used in this report does not conform to the Pliocene age of the Tehama as used by the U.S.

In the northeastern part of the Sacramento Valley, the continental rocks and deposits of Tertiary and Quaternary age are chiefly of Pleistocene age (Harwood and others, 1981) and were derived largely from the Tuscan Formation. The continental rocks and deposits in this area dip gently southwestward. They consist in part of a heterogeneous mix of gravel, sand, silt, and clay, and in large part they have been designated as fanglomerate because they are cemented in places and contain beds of sandstone and conglomerate (California Department of Water Resources, 1978, p. 26, pl. 2; Olmsted and Davis, 1961, p. 89). Thickening from east to west, the fanglomerate ranges in thickness from less than 150 feet north of Pine Creek to more than 600 feet west of Chico (Olmsted and Davis, 1961, p. 88-89). For wells pumped exclusively from the fanglomerate, yields ranged from 400 to 2,800 gal/min, although overall the fanglomerate is not very permeable (California Department of Water Resources, 1978, p. 26; Olmsted and Davis, 1961, p. 90).

Along the eastern flank of the Central Valley, from near Oroville to near Merced, the continental rocks and deposits dip gently southwestward (pls. 1 and 2) and in places successively overlie the pre-Tertiary rocks, the Ione, the Valley Springs, and the Mehrten Formations. Derived in large part from the pre-Tertiary rocks of the Sierra Nevada, they include the Laguna Formation and consist of a heterogeneous mix of generally poorly sorted clay, silt, sand, and gravel. Olmsted and Davis (1961, p. 84) said that in the Sacramento Valley the Laguna Formation contains abundant beds of somewhat clayey silt to silty fine sand, some well-sorted sand in relatively thin zones, and scarce, poorly sorted gravel beds. Marchand and Allwardt (1981, p. 21-28), however, noted that in the northeastern part of the San Joaquin Valley the Laguna contains a number of coarse-grained beds.

The California Department of Water Resources (1978, fig. 6) showed that near the Sacramento River in the southeastern part of the Sacramento Valley the continental rocks and deposits overlie the Mehrten Formation and attain a maximum thickness of more than 2,500 feet. In the Modesto-Merced area of the San Joaquin Valley, the continental rocks and deposits range in thickness from less than 50 feet to more than 1,000 feet, where they are considered as equivalent to the older alluvium and the continental deposits of Page and Balding (1973, fig. 6). Moreover, in the western parts of these areas, the continental rocks and deposits in part contain saline water (pl. 3) (Page and Balding, 1973, fig. 6).

In the Sacramento Valley, yields to wells in this area ranged from about 100 to 3,700 gal/min and, in the San Joaquin Valley, from about 20 to about 4,500 gal/min (Page and Balding, 1973, p. 28). In the Modesto-Merced area, both the mean and median yield to 96 large wells in the unit mapped as older alluvium was 1,900 gal/min (Page and Balding, 1973, fig. 5, p. 28).

From near Merced to near Richgrove, the continental rocks and deposits along the eastern flank of the valley lie unconformably over the pre-Tertiary rocks of the Sierra Nevada; south of Richgrove to the extreme southeastern part of the valley, they lie unconformably over pre-Tertiary rocks and also over marine rocks and deposits of Tertiary age (pl. 2). In the subsurface the continental rocks and deposits dip gently southwestward and overlie pre-Tertiary rocks, marine rocks and deposits of Tertiary age, undifferentiated marine and continental rocks and deposits of Tertiary age, and such continental rocks and deposits of Tertiary age as the Mehrten Formation (Croft, 1972, pls. 1 and 3; Croft and Gordon, 1968, pls. 4 and 7; Lofgren and Klausing, 1969, figs. 4 and 5; Mitten and others, 1970, pl. 1; Page and Balding, 1973, fig. 6).

In this area, the continental rocks and deposits of Tertiary and Quaternary age consist of lenses of clay, silt, sand, and gravel that were derived chiefly from the Sierra Nevada and that are largely arkosic, generally poorly sorted, and in places cemented; they also consist of mudstone, sandstone, and conglomerate (Bartow and Doukas, 1978). Croft and Gordon (1968, pl. 4) showed that in the Hanford-Visalia area (pl. 2) the continental rocks and deposits grade from oxidized deposits of brown and reddish-brown beds to reduced deposits of bluish-green beds, which indicates a change from subaerial to subaqueous deposition. In the Fresno area and in part of the Hanford-Visalia area, an abrupt change on electrical logs from high resistivities in the upper part of the continental rocks and deposits to low resistivities in the lower part was interpreted as a change from mostly coarse-grained sediment in the upper part to mostly fine-grained sediment, respectively (Page and LeBlanc, 1969, fig. 4). In these areas, the coarser sediment was mapped as older alluvium, and the finer sediment as continental deposits by Croft and Gordon (1968, p. 23, pls. 4-7) and Page and LeBlanc (1969, p. 14-15, pls. 4 and 6).

In the Fresno area (pl. 2), yields to wells in the upper part of the continental rocks and deposits—mapped as older alluvium by Page and LeBlanc (1969, p. 21, pls. 4 and 6)—ranged from about 20 to 3,500 gal/min and averaged about 900 gal/min. In this area, water wells generally do not penetrate the lower part of the continental rocks and deposits, which were mapped as continental deposits by Page and LeBlanc (1969, p. 14, pls. 4 and 6). In the Hanford-Visalia area, yields to wells in the upper part of the continental rocks and deposits were not estimated, but yields to wells in the

lower part reportedly ranged from 500 to 2,500 gal/min in the reduced parts and from 100 to 500 gal/min in the oxidized parts (Croft and Gordon, 1968, p. 18-19). In the Richgrove area, the continental rocks and deposits—mapped as continental deposits by Hilton and others (1961)—were reported as moderately to highly permeable and a major source of water; farther south, they were reported as only moderately permeable (Hilton and others, 1961, table 2; Wood and Dale, 1964, p. 38).

In the extreme southwestern part of the San Joaquin Valley and along most of its western flank, the continental rocks and deposits make up the Tulare Formation, which in many places is overlain by younger deposits (pl. 2, table 2). There, the continental rocks and deposits dip gently northeastward beneath the valley.

Woodring and others (1940, p. 13) defined the Tulare Formation as the youngest folded strata exposed in the Kettleman Hills. They defined the base of the Tulare Formation as the layer just above the upper *Mya* zone of the San Joaquin Formation (Woodring and others, 1940, p. 13-14). Upper *Mya* zone refers to the uppermost strata in which the burrowing pelecypod (clam, *Mya*) occurs in the San Joaquin Formation. The folded strata and upper *Mya* zone have been used by other workers for mapping the Tulare either along the western flank of the valley or in the subsurface, but where these criteria are absent most workers have found it very difficult to map either the upper or the lower contact of the Tulare Formation (Hotchkiss and Balding, 1971, p. 18-19; Miller and others, 1971, p. 21; Wood and Dale, 1964, p. 38-39; Wood and Davis, 1959, p. 22-23).

The Tulare Formation conformably overlies the San Joaquin Formation just above the upper *Mya* zone in the Kettleman Hills and in the subsurface east of the Hills, but where it is exposed elsewhere in the Coast Ranges, it generally lies unconformably on Pliocene and older formations. In the southwestern part of the San Joaquin Valley, the exposed Tulare ranges in thickness from a few tens of feet to more than 4,000 feet (Wood and Dale, 1964, p. 39); beneath the valley in this area, the thickness of the Tulare Formation and overlying deposits was not estimated. Northward from the Elk Hills to the Kettleman Hills, the exposed Tulare ranges in thickness from a few tens of feet along the western flank of the valley to about 3,500 feet in the Kettleman Hills (Wood and Davis, 1959, p. 23; Woodring and others, 1940, p. 14). Beneath the valley in this area, the thickness of the Tulare Formation and overlying deposits is not well known, but data compiled by Wood and Davis (1959, table 4) indicate that the thickness of the Tulare Formation ranges from about 200 feet at North Belridge to about 5,000 feet beneath the Kettleman Plains. Beneath the Kettleman Plains, the Tulare Formation and overlying deposits are as much as 6,500 feet thick (Woodring and others, 1940, p. 51). Miller and others (1971, p. 23) said that the exposed Tulare has a maximum thickness of about 2,600 feet in the northern part of the Kettleman Hills and that north of the Hills the thickness of the exposed Tulare does not exceed 350 feet. In the subsurface, the Tulare Formation, together with overlying deposits and some interbedded deposits from the Sierra Nevada, ranges in thickness from about 3,300 feet in the southern part of the Los Banos-Kettleman City area to about 900 feet in the northern part (Miller and others, 1971, pl. 3). Hotchkiss and Balding (1971, p. 18-19, pl. 1) estimated that in the Tracy-Dos Palos area the Tulare Formation and overlying deposits range in thickness from 0 to about 1,100 feet.

Most of the continental rocks and deposits along the western flank of the San Joaquin Valley consist of reworked sedimentary material that was derived from the older rocks of the Coast Ranges and deposited as alluvial-fan, flood-basin, deltaic, or lacustrine and marsh deposits. Miller and others (1971, pl. 4) showed that in the Los Banos-Kettleman City area the continental rocks and deposits derived from the Coast Ranges overlie and are interbedded with arkosic continental rocks and deposits from the Sierra Nevada. In the Los Banos-Kettleman City area and perhaps other parts of the valley, the gradual eastern extension of sediments from the Coast Ranges indicates that the topographic axis migrated eastward (Miller and others, 1971, p. 24, pl. 4).

The continental rocks and deposits in this part of the San Joaquin Valley consist principally of unconsolidated, generally poorly sorted deposits of clay, silt, sandy clay and silt, sand, clayey sand and silty sand, gravel, and clayey, silty, and sandy gravel. Locally, the Tulare Formation consists of consolidated sediment such as conglomerate and sandstone, and the lower part of the formation in the Kettleman Hills contains abundant pyroclastic material (Woodring and others, 1940, p. 13). Furthermore, the continental rocks and deposits consist in part of widespread silt and clay deposits of chiefly lacustrine origin (see "Lacustrine and Marsh Deposits").

Along the western side of the valley south of the Tulare Lake bed, the continental rocks and deposits contain mostly saline water, and north of Tulare Lake bed they contain mostly fresh water (Hotchkiss and Balding, 1971, p. 18; Miller and others, 1971, pls. 3 and 4; Page, 1973). As a consequence, in the southwestern part of the San Joaquin Valley, few deep-water

wells penetrate the continental rocks and deposits, and not much is known about yields to wells.

Nevertheless, 344 water wells were investigated in this area, and the reported average yield to irrigation wells was about 600 gal/min from alluvium of Pleistocene and Holocene age as mapped by Wood and Davis (1959, p. 28 pl. 1).

Along the western flank of the valley, from Anticline Ridge to Cantua Creek in the Los Banos-Kettleman City area, alluvial-fan deposits of the Tulare Formation were drilled through as much as 2,800 feet in order to tap more permeable deposits in the underlying San Joaquin and Etchegoin Formations (Miller and others, 1971, p. 28). Northwest and southeast of this area the deposits are coarser grained and more permeable. In the Tracy-Dos Palos area (pl. 2), yields to wells, mostly from the Tulare Formation, ranged from about 40 gal/min to 3,300 gal/min; most wells in the area averaged much more than 1,000 gal/min (Hotchkiss and Balding, 1971, fig. 7).

In the northern, northwestern, and western Sacramento Valley, most of the continental rocks and deposits constitute the Tehama Formation. In turn, the Tehama is overlain in many places by younger and much thinner deposits, including the Red Bluff Formation. As in most other areas in the Central Valley, the subsurface contact between these units is difficult to determine. Near its base, however, the Tehama Formation, as well as the Tuscan Formation (see "Tuscan Formation"), in places contains the Nomlaki Tuff Member of late Pliocene age. Where present, the tuff serves as an excellent marker bed. Nevertheless, because the lithology of the Tehama is similar to that of some older rocks and deposits in the valley, the basal part of the Tehama as mapped in the subsurface probably contains some of these older units. The maximum thickness of the continental rocks and deposits is more than 2,000 feet in the northern part of the Sacramento Valley and about 3,000 feet in the south-central part; in these areas, the Tehama Formation constitutes the thickest part (California Department of Water Resources, 1978, fig. 6). Throughout most of the western side of the Sacramento Valley, the Tehama averages about 2,000 feet in thickness (California Department of Water Resources, 1978, p. 25). At depth, the continental rocks and deposits, including the Tehama Formation, contain saline water (pl. 3) (Berkstresser, 1973; California Department of Water Resources, 1978, fig. 6).

Russell (1931, p. 27 and 31) considered the Tehama Formation to be of fluvial origin, and, because the fine-grained beds dominate, he concluded that the sediments were deposited under flood-plain conditions. The Tehama consists of poorly sorted deposits of clay, silt, clayey silt, sandy silt and clay, and silty sand containing generally thin lenses of gravel and sand; in areas of outcrop, it consists chiefly of siltstone, sandstone, and conglomerate (Helley and others, 1981, p. 11). However, in U.S. Geological Survey test hole 12N/1E-34Q1, which was drilled to a depth of 2,500 feet and which probably penetrated the total thickness of the Tehama Formation, virtually no consolidated sediments were found above a depth of 2,000 feet (French and others, 1982, table 2). This difference in consolidation between beds in areas of outcrop and beds in the deep subsurface indicates that, for some beds at least, consolidation probably was the result of exposure and weathering; however, farther out in the valley, beds in the subsurface generally have not had as much exposure or weathering. A simple example is shown by cores of clay taken from well 34Q1. When these cores were examined as they came from the borehole, the clays were saturated and plastic, but after a few months in storage they were dry and hard.

Younger deposits within the continental rocks and deposits consist of heterogeneous mixes of clay, silt, sand, and gravel, which in places are cemented and contain hardpan. Alluvial deposits underlying the Stony Creek alluvial fan are coarser grained than in any other place in the Sacramento Valley (California Department of Water Resources, 1978, p. 30), and the proportion of sand and gravel to depths of 200 feet averages about one-third (Olmsted and Davis, 1961, p. 106). Between Willows and Williams (pl. 1), alluvial-fan deposits are finer grained than those to the north, and wells must penetrate the underlying Tehama to get significant yields of water (California Department of Water Resources, 1978, p. 30). South of Williams to Cache Creek, the alluvial-fan deposits consist mostly of fine-grained sediments containing some lenses of poorly sorted sand and gravel. Farther south, both Cache and Putah Creeks have deposited extensive beds of sand and gravel, but, even in these areas, sand and gravel in the upper 200 feet make up only 25 to 30 percent of the deposits (Olmsted and Davis, 1961, p. 106-107).

In the Sacramento Valley, yields to wells from the Tehama Formation differ considerably. The California Department of Water Resources (1978, p. 25) reported the following yields: west of Red Bluff and Corning, yields to wells ranged from about 500 to 950 gal/min; in T. 25 N., R. 3 W., from about 500 to 2,200 gal/min; west of Artois, from about 950 to 1,900 gal/min; and, near Arbuckle, irrigation wells were reported to yield from about 1,900 to 4,000 gal/min. Yields to wells from the overlying deposits also differ, and, in places along the western flank of the Sacramento Valley, some of the deposits are unsaturated. Average yields to wells in the Stony Creek area are about 2,000 gal/min. One well in the Cache Creek area yielded 1,400 gal/min from

the alluvial-fan deposits; this yield was not considered to be unusual (Olmsted and Davis, 1961, p. 106).

Lacustrine and marsh deposits

Lacustrine and marsh deposits crop out in the San Joaquin Valley beneath Buena Vista, Kern, and Tulare Lake beds, and also along the western flank of the valley just west of Los Banos (pl. 2, table 2). They do not crop out in the Sacramento Valley.

If it were possible to open the earth and look at the lacustrine and marsh deposits beneath Tulare Lake bed, they would appear as a thick plug of mostly blue-green or gray clay and silt, from which lenses of clay and silt emanate at irregular intervals (pl. 3). Sediment from test holes less than 100 feet deep indicated that at least one fine-grained deposit beneath Tulare Lake bed is a distal part of an alluvial-fan deposit derived from the Coast Ranges (B. F. Atwater, U.S. Geological Survey, oral commun., 1983). Some fine-grained beds probably include flood-basin deposits. Nevertheless, this plug of chiefly lacustrine and marsh deposits and its related lenses probably warrant formational status. If recognized as a formation, the various lenses would be members, and instead of the Corcoran Clay Member (Pleistocene) being a member of both the Tulare Formation (Pliocene and Pleistocene) and the Turlock Lake Formation (Pleistocene), as indicated below, it would be a member of only one formation. Furthermore, instead of the other lenses possibly being named members of various formations, these lenses would be members of only one formation, and their origin would be more readily apparent.

In the SW¼ T. 23 S., R. 20 E., the lacustrine and marsh deposits are more than 3,600 feet thick. Croft (1972, pls. 1-6, p. 17-21) mapped six of the lenses and designated them from youngest to oldest by the letters A through F. The A, C, and E clays of Quaternary age are the more extensive. In fact, the E clay in the San Joaquin Valley is the most extensive lacustrine clay in the entire Central Valley.

Beneath Buena Vista and Kern Lake beds, flood-basin deposits and fine-grained facies of alluvium have been included with the lacustrine and marsh deposits; those deposits are composed chiefly of silt, silty clay, sandy clay, and clay, interbedded with some sand lenses (Wood and Dale, 1964, p. 43). In that area, such deposits are considered to be at least 1,000 feet thick.

Elsewhere in the Central Valley, aside from the widespread A, C, and E clays and the deposits beneath Tulare Lake bed, lacustrine and marsh deposits are considerably thinner and are reported only in local areas (Redwine, 1972, p. 157; Russell, 1931, p. 27; Page and Bertoldi, 1983, p. 16-17).

Modified E clay—The E clay of Pleistocene age includes the diatomaceous clay of Davis and others (1959, pl. 14) and an extension of that clay mapped by Croft (1972, p. 19, pl. 4) in the area of Buena Vista and Kern Lake beds. In turn, the diatomaceous clay is considered equivalent to the Corcoran Clay Member of the Tulare Formation. In the northeastern part of the San Joaquin Valley, where virtually all the continental deposits were derived from the Sierra Nevada, Marchand and Allwardt (1981, p. 34) considered the Corcoran Clay Member of the Tulare Formation also to be a member of the Turlock Lake Formation. Janda and Croft (1967, p. 164) reported that a volcanic ash and pumice, the Friant Pumice Member of the Turlock Lake Formation (Marchand and Allwardt, 1981, p. 34), can be traced discontinuously from near Friant, where it is exposed, to beneath the axis of the San Joaquin Valley, where it conformably overlies the Corcoran Clay Member. G. B. Dalrymple (Marchand and Allwardt, 1981, p. 34) dated two separate collections of the Friant Pumice Member as 612,000±31,000 years and 618,000±31,000 years before the present.

Croft (1972, p. 19, pl. 4) mapped the E clay in the area around Buena Vista and Kern Lake beds. Diatoms in that area have not been reported in the clay. Later, R. E. Brown (California Department of Water Resources, written commun., 1981) compiled eight geologic sections for the area at and around Buena Vista and Kern Lake beds and correlated an extensive clay bed by using electric logs and by intensive checking of his sections and Croft's mapping. Brown concluded that, in the area at and around Buena Vista Lake bed, the E clay lies from 100 to 300 feet above the depth that Croft mapped it. Inasmuch as a great many more electric logs, as well as additional drillers' logs, were available to Brown than to Croft, Brown's data were used in mapping the depth to his E clay, herein called the modified E clay at and around Buena Vista and Kern Lake beds (pl. 4).

The modified E clay ranges in depth from 0 foot at the outcrop along the western flank of the valley to about 900 feet beneath Tulare Lake bed (pl. 4). In some areas, such as near Little Panoche Creek and the Fresno River, the modified E clay may have been eroded, as indicated by the truncated depth contours. Although the depth map properly cannot be used as a structural contour map, the gentle relief of the San Joaquin Valley permits some structural interpretation of the map. The most striking features shown on plate 4 are (1) the number of basins in the clay, (2) a general deepening from north to south, and (3) a trough that underlies virtually the entire western part of the San Joaquin Valley. Some of the deeper parts of the ancient lake probably are indicated in areas where the basins approximately coincide with thicker sections of

the clay, such as near Cantua and Panoche Creeks and beneath parts of Tulare Lake bed (pls. 4 and 5); these and other basins may also be the result of structural deformation. The trough reflects the syncline that underlies the western part of the San Joaquin Valley (Hoots and others, 1954, pl. 5).

The modified E clay ranges in thickness from less than 10 feet in places near its edge to more than 160 feet beneath the western part of Tulare Lake bed (pl. 5). Where the modified E clay is bifurcated (pl. 5), an upper bed of clay or silty clay is separated from a similar lower bed by a bed of coarser grained sediment that ranges in thickness from about 5 to 70 feet and averages about 20 feet.

The E clay, or modified E clay, may have been deposited in a large lake that was coeval with glaciation in the Sierra Nevada (Janda and Croft, 1967, p. 168), but Davis and others (1977, p. 389) suggested that the E clay may represent an interglacial stage.

A AND C CLAYS—The C clay of Pleistocene age was mapped as being beneath the San Joaquin Valley from about Mendota on the north to Goose Lake bed on the south (Croft, 1972, pl. 5; Page and LeBlanc, 1969, pl. 9). It underlies the topographic axis of the valley and ranges in depth from about 100 to 330 feet and in thickness from about 5 to 45 feet. The C clay may have been deposited in a large lake in the valley coeval with a glacial stage in the Sierra Nevada (Janda and Croft, 1967, p. 168; U.S. Geological Survey, 1965, p. A100).

The A clay of Pleistocene and Holocene(?) age (Croft, 1972, p. 21) was mapped as being beneath the San Joaquin Valley from near Mendota on the north to Kern Lake bed on the south (Croft, 1972, pl. 6; Page and LeBlanc, 1969, pl. 9); it also underlies the topographic axis of the valley. The A clay ranges in depth from less than 10 to about 70 feet and in thickness from about 5 to 70 feet. Janda and Croft (1967, p. 168) considered the A clay to have been deposited in a large lake coeval with the Wisconsin glaciation. Radiocarbon dates for wood collected 3 feet beneath the A clay and for wood within the upper part of the clay are 26,780±600 years and 9,040±300 years, respectively (U.S. Geological Survey, 1965, p. A99-A100; Croft, 1972, p. 20-21).

Fine-grained beds, such as the A, C, and E clays, do not yield much water to wells, unless compacted; instead, they impede the vertical movement of water and function as confining beds—that is, where underlying sediments are fully saturated, ground water is at greater than atmospheric pressure.

LACUSTRINE-CLAY DISTRIBUTION—As mentioned, at least two extensive lacustrine clays (E and C clays) of Pleistocene age and one (A clay) of Pleistocene and Holocene(?) age underlie the San Joaquin Valley; similar extensive clays have not been found in the Sacramento Valley. Probably the absence of an active basin-forming structural depression similar to that underlying the Tulare Lake bed area of the San Joaquin Valley accounts for the lack of widespread lacustrine deposits in the Sacramento Valley. Three major structural depressions, however, have been designated as the three Tertiary depocenters of the Central Valley; they underlie the Tulare Lake bed and Buttonwillow area, the Kern Lake bed area, and the delta area (Zieglar and Spotts, 1978, fig. 7). Only the depocenter underlying the Tulare Lake bed area contains a thick—more than 3,600 feet—virtually continuous section of continental sediments of silt and clay. Depocenters underlying the other areas contain fine-grained sediments that are not nearly as thick and that are interbedded with coarse-grained sediments.

Many workers have suggested that, in the Tulare Lake bed area, damming by the growth of alluvial fans from the Kings River on the east and Los Gatos Creek on the west was the cause of the interior drainage there (Mendenhall and others, 1916, p. 21; Davis, 1933, p. 224; Hinds, 1952, p. 150). Davis and Green (1962, p. 82-91), however, showed that Tulare Lake bed is an area of structural downwarping and that active tectonic subsidence is the cause of the basin. That basin is underlain chiefly by fine-grained lacustrine and marsh deposits more than 3,600 feet thick. Those deposits range in age from late Pliocene to Holocene (Croft, 1972, p. 18); therefore, lakes and marshes have existed in this area for more than 2 million years. Being structurally downwarped, the area has been and is a basin to which water flows through large and small streams from the surrounding area. Deltaic deposits in the deep subsurface are further evidence that this basin has been receiving water from surrounding areas for an extremely long time. For example, Miller and others (1971, p. 28, pl. 4) mentioned that deltaic deposits just north of Tulare Lake bed begin 350 feet below the surface and are about 2,000 feet thick. In the past, and even today, lakes in the area have expanded and contracted, as indicated by the A, C, and E clays and by flooding of the lake bed in recent times. These clays probably represent times when large quantities of water drained into the ancient Tulare Lake bed area and expanded the existing lake.

The expansion of the lakes and the resulting clays might have occurred in two ways: (1) as water from the surrounding area drained into the ancient basin, the lake expanded; and (2) streams to the north formed, or had already formed, dams by building alluvial fans out into the axis of the valley, so that an expanding lake may have been dammed by alluvial fans. Recently, B. F. Atwater, W. R. Lettis, and David Adam of the U.S.

Geological Survey (written commun., 1982) suggested that large lakes in the basin may have formed as a result of high dams (50 feet) built by brief pulses (less than 10,000 years) of aggradation by large rivers, and that smaller lakes may have resulted from lesser aggradational events, perhaps with the aid of tectonic subsidence at the lake site. Shlemon (1971, p. 436) said that studies of alluvial sequences in the Central Valley have shown that periods of alluvial-fan formation probably correlate with glacial advances in the Sierra Nevada, and that relative landscape stability and soil formation occurred during interglacial time. Atwater, Lettis, and Adam (written commun., 1982) said that glacially induced dams apparently persisted into interglacial periods.

Shlemon (1971, fig. 13) mapped three Pleistocene river channels in the Mokelumne River area (pl. 1). He inferred that the oldest channel deposits could be correlated with sediments 100 miles to the south that were dated as approximately 600,000 years old (Shlemon, 1971, p. 433); those sediments are undoubtedly the Friant Pumice Member of the Turlock Lake Formation. Shlemon (1971, p. 434, fig. 3) said that at Lodi the channel deposits lie at a depth of about 250 feet, and he inferred that about 20 miles west of Lodi the channel deposits lie at a depth of about 380 feet. The inferred age of the channel deposits, of course, correlates with the approximate age of the modified E clay (see "Modified E Clay"), and the depths of the channel deposits approximate those of the modified E clay near Tracy (pl. 4). While the ancient Mokelumne River was building its fan out toward the delta area, other rivers in the Central Valley probably were building fans, too. Thus, alluvial dams probably were present in the axis of the Central Valley when the modified E clay was being deposited in the lake that was expanding northward from the Tulare Lake bed area. Perhaps northward-flowing rivers breached the alluvial dams of rivers south of Tracy and north of the Kings River, or perhaps the expanding lake captured the water from these rivers, breached a dam, and continued its northward expansion.

Shlemon (1971) mapped a second channel in the Mokelumne River area. The deposits of this channel lie at a depth of about 90 feet beneath Lodi; 4 miles west, the depth is about 120 feet. These deposits are inferred to be between 75,000 and 300,000 years old (Shlemon, 1971, p. 434, fig. 3). The depths of these channel deposits approximate those of the C clay, and the deposits and the clay may be similar in age.

The third channel mapped by Shlemon (1971, p. 434-435, fig. 3) lies at a depth of about 40 feet beneath Lodi; 3 miles west, the depth is about 50 feet. Shlemon (1971, p. 435) considered the deposits of this channel to be somewhat older than 27,000 years and perhaps correlative with the age-dated lacustrine sediments of Janda and Croft (1967, p. 168), the A clay. Both the A and C clays were mapped chiefly south of Mendota, and there the lakes in which those clays were deposited could have been dammed by alluvial fans of the ancient San Joaquin or Kings Rivers.

The earliest indication that the Sacramento Valley probably is not underlain by a widespread fine-grained bed was given by Bryan (1923, p. 91), who said, "Only a small number of flowing wells have been obtained in Sacramento Valley, and of these only a few have strong flows. There is no large area of artesian flow, as in San Joaquin Valley." Before Bryan's study, Mendenhall and others (1916, pl. 1) had mapped a large area in the San Joaquin Valley that was underlain by confined ground water and that is roughly comparable to the area underlain by the modified E clay (pl. 4). This lack of a "large area of artesian flow" in the Sacramento Valley indicates the absence of a widespread confining bed.

Between February 1979 and October 1980, the U.S. Geological Survey drilled seven test holes in the Sacramento Valley (pl. 1); well 5N/1E-34A was drilled by the U.S. Army Corps of Engineers. The holes ranged in depth from 900 to 2,500 feet. At test holes 12N/1E-34Q1, 12N/3E-2G1, and 19N/1E-32G1, three potentiometric tubes were placed in each hole and bottomed at three different depths (French, Page, and Bertoldi, 1982 and 1983; French, Page, Bertoldi, and Fogelman, 1983). Fluctuations of water levels in those tubes indicated that ground water was confined at most depths. As numerous fine-grained beds underlie the test-hole sites, landing a tube beneath any one of the beds probably would result in recording some confinement. If a fine-grained bed could have been correlated from one test-hole site to another, then it could have been shown that a widespread fine-grained bed existed in the Sacramento Valley and that confinement of ground water is of more than local extent.

One of the purposes of drilling the test holes was to determine whether a diatomaceous clay of Pleistocene age, cored in test hole 12N/1E-34Q1 near Zamora from depths of 534 to 544 feet (Page and Bertoldi, 1983, table 1), could be correlated with a diatomaceous clay found at depths of 18 to 22 feet in test hole 5N/1E-34A near the northern edge of the Montezuma Hills (pl. 1). The diatomaceous clay near the Montezuma Hills was thought to be comparable in age and deposited in an environment similar to that of the Corcoran Clay Member of the Tulare Formation (Olmsted and Davis, 1961, p. 74). It is not known whether the clay near the Montezuma Hills is a northern extension of the Corcoran Clay Member.

Because no diatoms were found in any of the cores taken from four test holes drilled between test holes

12N/1E-34Q1 and 5N/1E-34A (pl. 2), the diatomaceous clay found in 34Q1 was considered a separate clay rather than an extension of the clay found near the Montezuma Hills (Page and Bertoldi, 1983, p. 17). Nor were diatoms found in test holes 12N/3E-2G1 near Nicolaus and 19N/1W-32G1 near Butte City. Therefore, the Pleistocene diatomaceous clay found in 12N/1E-34Q1 was considered to be of only local extent.

Furthermore, examination of more than 900 electric logs indicated that thick, fine-grained lacustrine deposits like those underlying the Tulare Lake bed area probably do not exist in the Sacramento Valley. Thomasson and others (1960, p. 85), however, mentioned dominantly fine-grained zones underlying T. 8 N., R. 1 E., which they said represent possible lake or flood-basin deposits; these zones also contain many coarse-grained beds (Thomasson and others, 1960, pl. 8). Olmsted and Davis (1961) and the California Department of Water Resources (1978) do not mention any thick, fine-grained lacustrine deposits in the Sacramento Valley. Redwine (1972, p. 156-157) considered the Tehama Formation to have been deposited chiefly on the west side of a broad, low-lying Sacramento Valley in flood plains and streams and locally in small, shallow, intermittent lakes, where diatomaceous claystone accumulated. Considering these data, a structural basin comparable to that beneath Tulare Lake Bed in the San Joaquin Valley probably is not present in the Sacramento Valley.

Although a structural depression exists in the delta area (Zieglar and Spotts, 1978, fig. 9), available data indicate that it probably did not contribute to the forming of widespread lakes, as is inferred for the structural depression in the Tulare Lake bed area. Large lakes may not have formed in the delta area because drainage from the Central Valley to the ocean probably took place near there between 0.6 and 3.3 million years ago (Sarna-Wojcicki, 1976, p. 25).

In the Sacramento Valley, then, water from the rivers of the surrounding area probably did not accumulate in a large, downwarping basin like the one in the Tulare Lake bed area because such a basin, in which large lakes could form and then expand, probably had not developed there. Instead, probably only small lakes existed in the valley. Before any large lakes could form, alluvial dams in the Sacramento Valley probably were breached by a throughflowing trunk stream comparable to the present-day Sacramento River. Consequently, at a time when widespread lacustrine clays were being deposited in large lakes in the San Joaquin Valley, lacustrine clays of only local extent probably were being deposited in relatively small lakes in the Sacramento Valley.

CONTINENTAL DEPOSITS (QUATERNARY)

Quaternary deposits are largely of Holocene age; along their outer margins, however, some may be of Pleistocene age. The deposits crop out chiefly along the major rivers and streams of the valley, as well as in other low-lying areas (pls. 1 and 2), and include river deposits, flood-basin deposits, and sand dunes, all of Holocene age. In places, they may include such deposits as the Modesto Formation of Pleistocene age.

River deposits (Holocene)

The river deposits crop out along the major rivers and streams of the Central Valley (pls. 1 and 2, tables 1 and 2) and include channel and flood-plain deposits. The river deposits are still accumulating, except where human activity intervenes. Channel deposits, which consist chiefly of sand and gravel, range in width from a few feet to nearly 1,000 feet. Flood-plain deposits generally are finer grained than channel deposits and consist chiefly of sand and silt, and they range in width from a few hundred feet to more than 3 miles. Because soil development and topography were the criteria for mapping river deposits, subsurface contact with underlying deposits is poorly defined. Olmsted and Davis (1961, p. 109) defined the river deposits as the predominantly coarse-grained deposits at relatively shallow depth that appear to be hydraulically continuous with the present stream channels, flood plains, and natural levees. The California Department of Water Resources (1978, p. 33) believed that the river deposits attain a maximum thickness of about 115 feet and that they are the most permeable deposits in the Sacramento Valley.

Flood-basin deposits (Holocene)

Flood-basin deposits crop out in low-lying areas throughout the Central Valley (pls. 1 and 2; tables 1 and 2). They result from flood waters entering low-lying basins and depositing mostly fine silt and clay and some fine sand. Flood-basin deposits grade into river deposits, rocks, and deposits of Tertiary and Quaternary age, and lacustrine and marsh deposits. As with most deposits of Quaternary age in the valley, contact with underlying deposits is difficult to determine. The California Department of Water Resources (1978, p. 32) stated, however, that the flood-basin deposits in the Sacramento Valley consist of as much as 160 feet of fine-grained sediments in the area west and south of Sacramento and that the deposits north

of the Sutter Buttes appear to be thinner, about 50 feet thick. In the San Joaquin Valley, the deposits were estimated to be as much as 100 feet thick (Page and Balding, 1973, p. 37). Because of their fine-grained nature, the flood-basin deposits would not yield much water to wells and would impede the vertical movement of water.

SAND DUNES (HOLOCENE)

Sand dunes crop out chiefly in the eastern part of the San Joaquin Valley (pl. 2, table 2). They range in thickness from 0 to about 140 feet and consist of generally cross-bedded, well-sorted, medium-to-coarse sand and some very fine to fine sand and silt (Page and LeBlanc, 1969, p. 25; Wood and Dale, 1964, p. 44-45). In most places, the sand dunes lie above the saturated zone, but their permeability permits recharge from stream runoff, precipitation, or irrigation return.

GEOLOGIC STRUCTURE

The large, asymmetrical, northwestward-trending trough of the Central Valley is the principal structure controlling the occurrence and movement of ground water in the area. Along the flanks of the valley, which are the flanks of the trough, deposits generally are much thinner than those underlying either the topographic axis of the valley or the more westerly structural axis of the trough. In general, most of the confinement of ground water occurs near the axis of the valley as a result of more extensive confining beds deposited there. Furthermore, because the flanks of the valley are higher than its axis, recharge from tributary rivers and streams, as well as from irrigation return, has caused heads in the ground water along the flanks to be higher than those along the axis, so that, overall, ground water moves from the flanks toward the axis and thence northward (San Joaquin Valley) or southward (Sacramento Valley) toward the delta area and points of ultimate discharge. And since development, some ground water moves toward large pumping depressions in various parts of the valley.

A number of secondary geologic structures in the Central Valley also influence the occurrence and movement of ground water. The Red Bluff arch at the northern end of the Sacramento Valley is a series of northeastward-trending anticlines and synclines that result in a structural barrier to ground-water movement (pl. 1) (California Department of Water Resources, 1978, p. 39). Faulting in the area (Harwood and Helley, 1982) may also affect ground-water movement. Although it probably is not a barrier to ground-water movement, the Chico monocline on the northeastern flank of the valley accounts for the nearly straight basin boundary that lies north of Pine Creek. The northward-trending structure, which lies south of the Red Bluff arch and which has been mapped as the Corning anticline, is expressed on the surface by a series of low-lying hills; in the subsurface it consists of two domes (Harwood and Helley, 1982). An extension of this structure is thought to have uplifted the Tuscan Formation near the Red Bluff Diversion Dam because the Tuscan lies at a shallower depth there than in nearby areas (California Department of Water Resources, 1978, p. 34). In the northwestern part of the valley, pre-Tertiary marine rocks have been uplifted along a fault at Orland Buttes; the fault and the rocks are probably barriers to ground-water movement. The Willows fault, which lies just southeast of the Orland Buttes, has no surface expression, but its presence has been inferred from changes in water level across the structure (California Department of Water Resources, 1978, p. 39). In the central part of the valley, ground water is diverted around the Sutter Buttes. Curtin (1971, p. 51-53) suggested that the mound of saline water on the south side of the Buttes (pl. 3) resulted from saline water migrating upward along a fault from underlying marine rocks. On the western side of the Sacramento Valley, the Tehama Formation has been folded by the uplift of the Dunnigan Hills anticline (pl. 1). Bryan (1923, p. 79, pl. 3) mapped a fault along the east limb of this anticline, as did Harwood and Helley (1982). The anticline and perhaps the fault extend northwestward. Near Arbuckle, one or both of these structures probably are barriers to ground-water movement (California Department of Water Resources, 1978, p. 39). The Plainfield Ridge lies south of the Dunnigan Hills anticline and is an anticlinal structure, the surface expression of which is a series of low hills; it lies parallel to the Dunnigan Hills anticline. This structure is a barrier to the eastward movement of ground water (California Department of Water Resources, 1978, p. 39). The Montezuma Hills in southwestern Sacramento Valley represent a broad, gentle uplift, which is reportedly modified by faulting (Olmsted and Davis, 1961, p. 130-131). It is not known whether the faults affect ground-water movement.

In the San Joaquin Valley, anticlinal folds such as Anticline Ridge, Guijarral Hills, Kettleman Hills, and Lost Hills restrict the movement of ground water from Pleasant Valley, Kettleman Plain, and Antelope Plain (pl. 2). Farther south, the Elk Hills and the Buena Vista Hills restrict the movement of ground water from Buena Vista Valley. In the southern part of the valley, the White Wolf fault is a barrier to ground-

water movement, as is the Edison fault along the southeastern part of the valley (Wood and Dale, 1964, p. 28-29). Other faults are present throughout the San Joaquin Valley, but they have not been shown definitely to restrict ground-water movement.

TEXTURE

"Texture," as used in the illustrations of this report, means the proportion of coarse-grained to fine-grained sediment in sedimentary rocks and deposits. Texture was mapped only above the base of fresh water. In this report, coarse-grained sediment is considered to consist principally of sand, clayey and silty sand, gravel, and clayey, silty, and sandy gravel; fine-grained sediment consists principally of clay, silt, and sandy clay and silt. In order to determine texture, 685 geophysical logs mostly from oil and gas wells were used. These logs show properties of sedimentary material and their included fluid, such as resistivity and spontaneous potential. The texture of sediments, as well as their depth and thickness, can be determined from geophysical logs (Schlumberger Ltd., 1972). In the sediments of the Central Valley, for example, high resistivities are interpreted as representing coarse-grained sediment and low resistivities as representing fine-grained sediment (fig. 4). The spontaneous potential also is a guide in determining coarse-grained and fine-grained sediment. Opposite a coarse-grained bed, the spontaneous-potential line, depending on water salinity in the bed and fluid salinity in the borehole, moves either to the right or left of a base line representing fine-grained sediment. Although coarse-grained and fine-grained sediment can be determined from geophysical logs, the logs cannot be used to determine whether the coarse-grained sediment is gravel or sand or whether a fine-grained sediment is silt or clay. Furthermore, geophysical logs cannot be used to determine the degree of cementation or sorting in a deposit; thus, some of the coarse-grained sediment may consist of conglomerate or sandstone, and some of the fine-grained sediment may consist of siltstone or claystone.

Using geophysical logs and a computer program written by H. T. Mitten of the Geological Survey (written commun., 1980), texture maps of the sediments beneath the Central Valley were made by computing and plotting the percentage of coarse-grained sediment by quarter townships in depth intervals of 300 feet (figs. 5-21). Also, texture columns and sections for selected areas and graphs of the frequency of occurrence of coarse-grained sediment by depth zones were made for both the Sacramento and San Joaquin Valleys (figs. 22-35). Many of the computations for texture were for depths below 300 feet because the

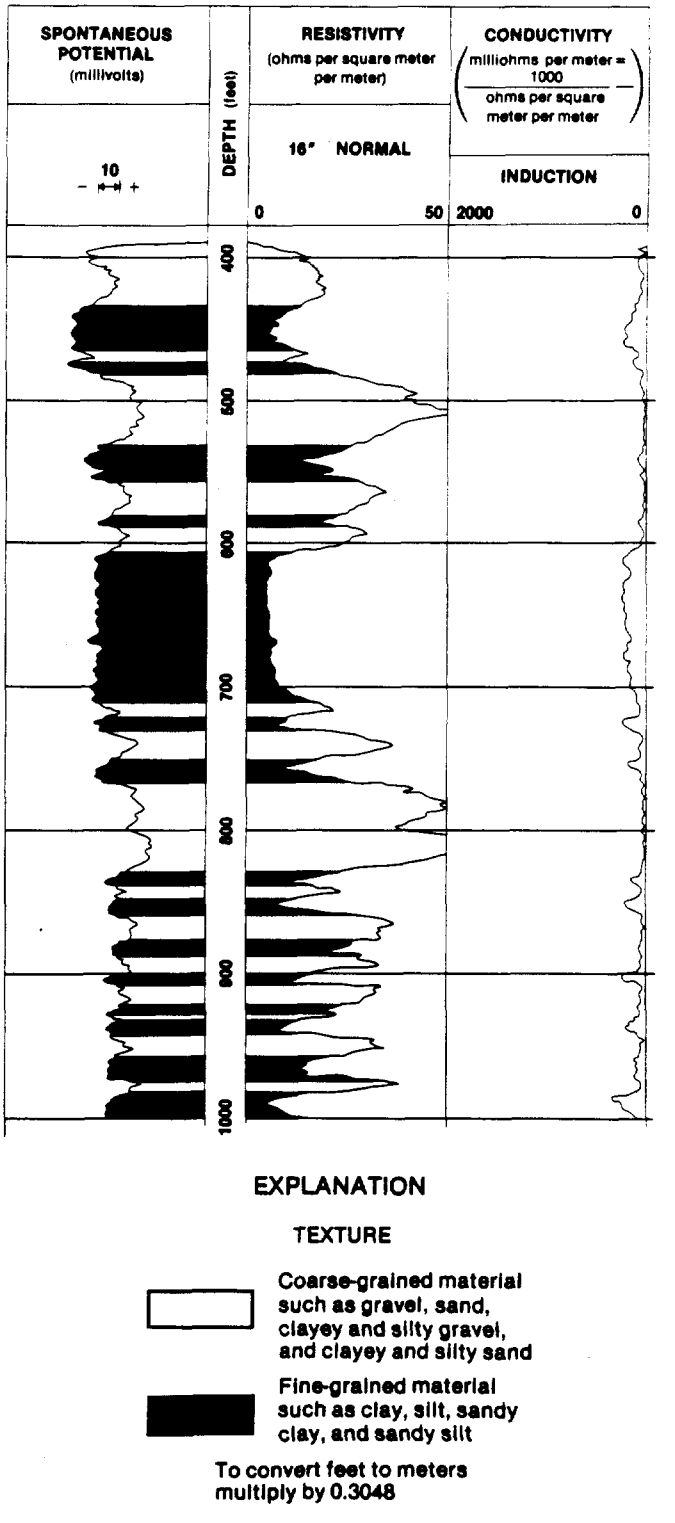

Figure 4. Geophysical logs for part of well 23S/23E-25E.

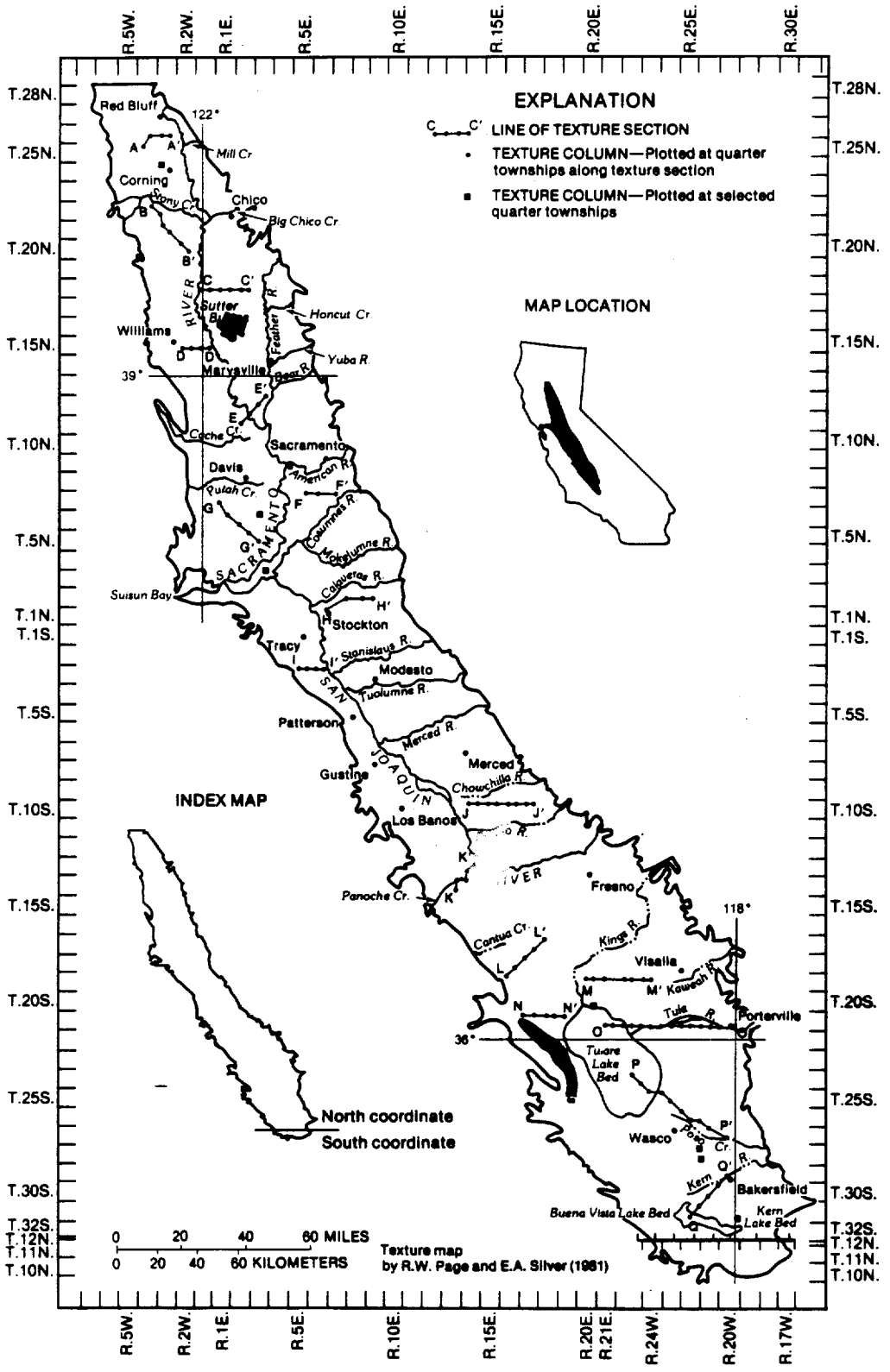

Figure 5. Location of texture columns and sections.

California Division of Oil and Gas requires that, before an oil or gas well may be drilled, a casing must be set in the ground from the surface to 10 percent of the total depth of the well. This casing blocks the recording of resistivity and spontaneous potential.

The maps and sections show texture down to the base of fresh water (Berkstresser, 1973; Page, 1973). They are not maps and sections for only one formation, and undoubtedly many of the indicated depth zones transgress formation contacts. In figure 35, the Sacramento Valley is considered to include all the area in the Central Valley from T. 1 N.(M) to T. 28 N(M), and the San Joaquin Valley, all the area from T. 1 S.(M) to T. 10 N.(S) (fig. 5).

The alluvial deposits of the Central Valley are a heterogeneous mixture of sediments, which, over short distances and depths, range from chiefly fine-grained sediments to chiefly coarse-grained sediments, and vice versa (figs. 6-34). Furthermore, the deposits do not always grade from chiefly coarse-grained sediments near the flanks of the valley to chiefly fine-grained sediments near its axis, although more gravel is likely to be found along the flanks of the valley and more sand near its axis. Nevertheless, some areas are underlain chiefly by coarse-grained sediment and others by fine-grained sediment, which indicates that sources and depositional environment for areas containing sediment of like size probably were similar for long periods of time.

In the San Joaquin Valley near Tulare Lake bed, the thick deposits of chiefly coarse-grained sediments at depths ranging from less than 300 feet to about 3,000 feet (figs. 5-15) probably are largely of deltaic origin (see "Lacustrine-Clay Distribution") and were formed where the streams of the alluvial fan dropped most of their remaining coarse-grained load as they entered lakes and marshes. West and southwest of Bakersfield, the chiefly coarse-grained sediments were deposited at depths ranging from less than 300 feet to about 3,900 feet (figs. 6-18) by the Kern River, its antecedents, and other streams in an area of rapid downwarping (de Laveaga, 1952, p. 102). Probably the sediments are largely alluvial-fan deposits, but near Buena Vista and Kern Lake beds some of the coarse-grained sediments are probably deltaic. Along the southeastern flank of the San Joaquin Valley from north of Bakersfield to T. 22 S., the mostly coarse-grained sediments indicated at depths greater than about 1,500 feet (figs. 11-15) are largely flushed marine rocks and deposits, such as the Santa Margarita Formation of various authors (see "Marine Rocks and Deposits (Tertiary)").

Some thick, mostly coarse-grained sediments underlie the southeastern Sacramento Valley from the American River south to the Calaveras River at depths ranging from less than 300 feet to about 2,100 feet (figs. 7-12). The sediments generally grade in a westerly direction from coarser to finer grained sediments and in large part are probably alluvial-fan deposits laid down by the American, Cosumnes, Mokelumne, and Calaveras Rivers and their antecedents. Furthermore, the great thickness of the mostly coarse-grained sediments, which extend from the basal part of the continental rocks and depostis to near land surface, indicates that they have been deposited in parts of this area for an extremely long time, probably much more than 1 million years (pl. 3). Farther north, at depths ranging from less than 300 feet to about 1,200 feet (figs. 6-9), the mostly coarse-grained sediments underlying the immediate area around Sutter Buttes probably were derived for the most part from streams draining the Buttes, where the carrying power of the streams increased as the rocks and deposits of the Buttes were uplifted. North of Sutter Buttes, the distribution of the mostly coarse-grained sediments at depths ranging from less than 300 feet to about 1,200 feet (figs. 6-9) indicates that Big Chico Creek, Stony Creek, the Feather River, and their antecedents probably have contributed proportionally more coarse-grained sediment to the Sacramento Valley than has the Sacramento River.

In the Central Valley, the thickest and most extensive sections of fine-grained sediment underlie Tulare Lake bed. There, the fine-grained sediments are more than 3,600 feet thick in places and contain very few coarse-grained beds. At depth, the sediments underlie an area of nearly 1,000 mi^2. For the most part, these chiefly lacustrine and marsh deposits are not shown on the texture maps because they generally lie below the base of fresh water and have been mapped for other reports (Croft, 1972, pls. 3 and 4; Page, 1983b, fig. 10) (pl. 3).

Other areas in the Central Valley are also underlain by mostly fine-grained sediments, but in those areas the fine-grained sediments are interbedded with coarse-grained sediments and are not nearly as thick or homogeneous as the fine sediments underlying Tulare Lake bed. Mostly fine-grained sediments lie along the southeastern flank of the San Joaquin Valley between Bakersfield and Portersville, at depths ranging from less than 300 feet to about 1,500 feet (figs. 6-10); along the western flank from north of the Kettleman Hills to Los Banos and the area just to the east, at depths ranging from less than 300 feet to about 2,700 feet (figs. 6-14); and on the northwestern flank just west and south of Tracy, at depths ranging from less than 300 feet to about 1,800 feet (figs. 6-11). Even in these areas, however, some mostly coarse-grained sediments are present (figs. 6-11). Many of these sediments probably were deposited in distal parts of alluvial fans or along flood plains, and in some areas they may have been deposited in small lakes and marshes. Furthermore, sediments derived from the Coast Ranges, such

as most of those along the western side of the valley, generally are finer grained than those derived from the Sierra Nevada (Croft, 1972, p. 15) (figs. 6-12).

In the Sacramento Valley, mostly fine-grained sediments underlie areas along its northeastern flank just south of Chico at depths ranging from about 600 feet to about 900 feet (fig. 8) and along its southwestern flank from just north of Cache Creek to T. 3 N. at depths ranging from less than 600 feet to about 2,700 feet (figs. 8-12, and 14). The mostly fine-grained sediments near Chico may consist in part of tuffaceous clay of the Tuscan Formation. As noted previously, the Tehama Formation, which underlies most of the western part of the Sacramento Valley, is composed of chiefly fine-grained sediments that for the most part were probably deposited under flood-plain conditions.

Selected texture columns also indicate the heterogeneity of the continental rocks and deposits (fig. 22). In the NW¼, T. 24 N., R. 3 W., the percentage of coarse-grained sediments increases below depths of about 600 feet; in the NW¼, T. 6 N., R. 3 E., the distribution of sediments has a more random pattern but shows a general increase in mostly coarse-grained sediment from depths of about 1,200 to 2,700 feet; and in the delta area in the NE¼, T. 3 N., R. 3 E., the percentage of coarse-grained sediments decreases below a depth of about 1,200 feet. In the San Joaquin Valley, the distribution of coarse-grained sediment is fairly uniform in the SE¼, T. 20 S., R. 20 E., but the percentage of coarse-grained sediment increases somewhat at depths between 1,500 and 2,400 feet; distribution of coarse-grained sediment also is fairly uniform in the NW¼, T. 28 S., R. 26 E., except for the smaller percentage of coarse-grained sediment between depths of 300 and 600 feet; distribution of coarse-grained sediment in the SW¼, T. 28 S., R. 26 E., is fairly uniform except for the very large percentage of coarse-grained sediment between depths of 300 and 600 feet; and in the SW¼, T. 31 S., R. 28 E., the distribution of coarse-grained sediment is fairly uniform to a depth of about 3,000 feet; below 3,000 feet the distribution is fairly uniform, but the percentage of coarse-grained sediment is smaller.

Obviously, local depositional environments have had a great effect on the distribution of coarse- and fine-grained sediments, as is indicated by the disparate patterns of sediment distribution in the texture columns for both the Sacramento and San Joaquin Valleys. The effect of local depositional environments also is indicated by changes in distribution over relatively small areas; for example, note the smaller percentage of coarse-grained sediment in the NW¼, T. 28 S., R. 26 E., compared with the percentage in the SW¼, T. 28 S., R. 26 E. (fig. 22). On the other hand, the effects of regional events, such as glaciation in the Sierra Nevada, are not readily apparent in these columns, maps, and sections (figs. 6-34).

Texture sections also indicate the lateral and vertical heterogeneity of the alluvial deposits in the Central Valley (figs. 22-34). Most of the sections were drawn to show changes in the percentage of coarse-grained sediment from high areas of present-day alluvial fans to low areas. Section E-E' (fig. 25) indicates the percentage of coarse-grained sediment in a low-lying area of the Sacramento Valley, where the percentage of coarse-grained sediment is generally small. In using the sections, it should be kept in mind that sediments in zones of equal depth were not necessarily deposited during the same time periods because depths of a given bed can differ greatly, as indicated by the modified E clay (pl. 4).

Many of the sections do not indicate a general decrease in the percentage of coarse-grained sediment from high to low areas, although deposits underlying high areas generally contain more gravel, and those underlying low areas, more sand. In both high and low areas many of the deposits probably are poorly sorted and are composed of clayey and silty sand or clayey, silty, and sandy gravel. Some of the coarse-grained sediment near the lower side of some sections probably was deposited by either the Sacramento River or the San Joaquin River, as in the SE¼, T. 26 N., R. 3 W., in section A-A' (fig. 23) or the NE¼, T. 1 N., R. 6 E., in section H-H' (fig. 26). Near the lower side of some sections, some of the fine-grained sediments are largely lacustrine and marsh deposits, as in the SW¼, T. 21 S., R. 21 E., and the SE¼, T. 21 S., R. 2 E., in secton O-O' (fig. 32) and in the SE¼, T. 24 S., R. 22 E., in section P-P' (fig. 33).

In the Central Valley, most of the deposits for which data are available contain no more than 40 to 60 percent of coarse-grained sediment (fig. 35), where coarse-grained sediment includes clayey and silty sand and gravel. Bar graphs are shown for only those depth zones that had 20 or more geophysical logs available. For the most part, data for the thick fine-grained sections underlying Tulare Lake bed were not included in the computations (see "Lacustrine and Marsh Deposits"). By comparing depth zones in figure 35 with the appropriate texture map (figs. 6-16), the areal distribution of the data used for the graphs can be determined. For example, in the San Joaquin Valley, a general increase in the percentage of coarse-grained sediment between the depths of 1,500 and 2,700 feet reflects in large part the influence of the mostly coarse-grained sediment around Tulare Lake bed and the Bakersfield area (figs. 11-14 and 35).

These maps and sections could be used by groundwater managers as a general guide for selecting test-hole sites and by modelers for assigning values for transmissivity and coefficient of storage with smaller values being assigned to the fine-grained sediments.

The maps and sections could also be used as a general guide for locating areas and depths of potential land subsidence. In alluvial basins where thick beds of fine-grained sediment have been deposited, as in the Central Valley, compaction of such beds results in land subsidence. For example, the greatest subsidence in the Central Valley has been in the Los Banos-Kettleman City area on the western side of the San Joaquin Valley (Poland and others, 1975, fig. 5). There, the maximum subsidence as of 1977 was 29.6 feet in an area about 10 miles southwest of Mendota (Ireland and others 1984, p. 7). Very little compaction has taken place in the upper 300 feet of the deposits in the Los Banos-Kettleman City area; most of the compaction has been between depths below land surface of about 300 and 1,100 feet. In this area, largely fine-grained sediments occur at those depths (figs. 7-9). Land has subsided in areas underlain by relatively coarse-grained sediment, as in the extreme southern part of the San Joaquin Valley, where a maximum subsidence of about 9 feet occurred between 1926 and 1970 (Ireland and others, 1982, fig. 30; Lofgren, 1975, pl. 4). There, however, some thick beds of clay and silt lie below depths of about 400 feet (Lofgren, 1975, tables 2 and 3). Land subsidence has also taken place along the western flank of the Sacramento Valley; from 1949 to 1964, for example, land at Zamora subsided more than 0.6 foot (Lofgren and Ireland, 1973, p. 18). Mostly fine-grained deposits underlie this part of the valley from depths of about 300 to at least 2,700 feet (figs. 7-14). Of course, other factors contribute to the amount and rate of compaction, such as water-level decline and the compressibility of the silt and clay beds.

SUMMARY AND CONCLUSIONS

The Central Valley of California comprises about 20,000 mi^2 and is about 400 miles long and averages about 50 miles wide. The valley contains the Sacramento Valley on the north and the San Joaquin Valley on the south. Within the Central Valley, the most extensive geomorphic units are (1) dissected uplands, (2) low alluvial plains and fans, (3) river flood plains and channels, and (4) overflow lands and lake bottoms. The most prominent geomorphic unit is Sutter Buttes.

Geologically, the Central Valley is a large, northwestward-trending, asymmetric structural trough that has been filled with as much as 6 miles of sediment in the San Joaquin Valley and as much as 10 miles of sediment in the Sacramento Valley; these sediments range in age from Jurassic to Holocene. Granitic and metamorphic rocks crop out along most of the eastern and southeastern flanks of the Central Valley. Marine rocks of pre-Tertiary age crop out along most of the western flank of the valley, and marine rocks and deposits of Tertiary age crop out around Sutter Buttes and along the western, southwestern, southern, and southeastern flanks of the valley. Volcanic rocks and deposits of Pliocene age crop out chiefly along the northeastern flank.

In a few places in the San Joaquin Valley, marine rocks and deposits have been flushed of saline water and contain fresh water, which they yield to wells. In the Sacramento Valley, marine rocks and deposits have not been reported as yielding fresh water to wells.

Of all the volcanic rocks and deposits, only the Tuscan Formation, which crops out in the northeastern part of the Sacramento Valley, is of major importance to the fresh ground-water basin of the Central Valley.

The post-Eocene continental rocks and deposits contain most of the fresh ground water in the Central Valley and crop out over virtually the whole valley. In most places, these rocks and deposits are underlain by or contain saline water at depth. They range in thickness from 0 along the flanks of the Central Valley to more than 15,000 feet in the extreme southern part. In the southern part, however, the base of fresh water lies at a maximum depth of about 4,700 feet—the thickest section of fresh water in the Central Valley.

Some of the continental rocks and deposits of Tertiary age are not of great importance to the ground-water basin of the Central Valley because they commonly contain saline water, or the nature of their sediments prevents large yields to wells, or both. Included in this group are the Ione Formation and the Valley Springs Formation.

On the other hand, the Mehrten Formation is a unit of continental rocks and deposits of Tertiary age that is of great importance to the fresh ground-water basin of the Central Valley. The Mehrten crops out along the eastern side of the Central Valley and yields large quantities of water to wells.

Although continental rocks and deposits of Tertiary and Quaternary age compose a number of formations and informal deposits, in total they make up the major aquifer of the Central Valley. In most places, the similarity of sediment type between the continental rocks and some underlying rocks and deposits and even between separate units of continental rocks and deposits makes mapping of subsurface geologic contacts, with any degree of certainty, difficult. In this respect, a unit that can be mapped on the surface is difficult to delineate in the subsurface, and although

such a unit can be called an aquifer, it merges with other units in the subsurface to form a major, widespread aquifer. In places, the aquifer is separated by confining beds which include lacustrine and marsh deposits that are much thicker and more extensive in the San Joaquin Valley than in the Sacramento Valley.

In the Central Valley, the continental rocks and deposits consist of heterogeneous mixes of gravel, sand, silt, and clay, and in places they contain beds of claystone, siltstone, sandstone, and conglomerate. Yields to wells from these rocks and deposits, except from the lacustrine and marsh deposits, differ greatly from place to place and range from about 20 to 4,500 gal/min.

Lacustrine and marsh deposits crop out in the San Joaquin Valley beneath Buena Vista, Kern, and Tulare Lake beds; they do not crop out in the Sacramento Valley. The expansion of the lakes and resulting deposition of extensive clays in the San Joaquin Valley might have occurred in two ways: (1) as water drained into the ancient structural basin beneath Tulare Lake bed, the existing lake or lakes expanded; and (2) streams to the north formed, or had formed, dams by building alluvial fans out into the axis of the valley, so that an expanding lake in the San Joaquin Valley could have been dammed by alluvial fans. In the Sacramento Valley, water from the rivers of the surrounding area probably did not accumulate in a large, downwarping basin like the one in the Tulare Lake bed area because such a basin, in which large lakes could form and expand, probably had not developed there. Before any large lakes could form behind alluvial dams, the dams in the Sacramento Valley probably were breached by a through-flowing trunk stream comparable to the present-day Sacramento River. Consequently, while widespread lacustrine clays were being deposited in large lakes in the San Joaquin Valley, lacustrine clays of only local extent probably were being deposited in relatively small lakes in the Sacramento Valley.

Continental deposits of Quaternary age include river deposits, flood-basin deposits, and sand dunes. The deposits crop out chiefly along the major rivers and streams of the valley as well as in other low-lying areas. River deposits include channel and flood-plain deposits; channel deposits consist chiefly of sand and gravel; and flood-plain deposits consist chiefly of sand and silt. River deposits are among the more permeable in the valley. Flood-basin deposits consist chiefly of fine silt and clay with some fine sand. Because of their fine-grained nature, the flood-basin deposits would not yield much water to wells and would impede the vertical movement of water. Sand dunes, which crop out chiefly in the eastern part of the San Joaquin Valley, consist of medium-to-coarse sand and some sand and silt that is very fine to fine. In general, the dunes are unsaturated, but they permit recharge from stream runoff, precipitation, or irrigation return.

The large structural trough of the Central Valley is the principal structure controlling the occurrence and movement of ground water in the area. As the flanks of the valley are higher than its axis, recharge from tributary rivers and streams, as well as from irrigation return, has caused heads in the ground water along the flanks to be higher than those along the axis. In the Central Valley, therefore, the overall ground-water movement is from the flanks toward the axis and from there toward the delta area. Secondary structures in the valley also influence the occurrence and movement of ground water, for example the Red Bluff arch at the northern end of the valley and the White Wolf fault at the southern end.

Texture columns, maps, and sections in depth intervals of 300 feet show that thick, chiefly coarse-grained sediments lie just north of Tulare Lake and that largely coarse-grained sediments lie in the central-eastern part of the valley and in the extreme southern part of the valley, as well as around and north of Sutter Buttes.

The thickest and most extensive sections of fine-grained sediment underlie Tulare Lake bed. There, the fine-grained sediments are more than 3,600 feet thick in places, and at depth underlie an area of nearly 1,000 mi^2. Other areas in the valley are also underlain by mostly fine-grained sediments, but in those areas the fine-grained sediments are interbedded with coarse-grained sediments and are not nearly as thick and homogeneous as the fine sediments underlying Tulare Lake bed. Such areas of mostly fine-grained sediments lie along the southeastern, northeastern, and western flanks of the valley.

The post-Eocene continental rocks and deposits of the Central Valley, therefore, constitute a heterogeneous mixture in which texture differs over short distances and depths from chiefly fine-grained to chiefly coarse-grained sediments and vice versa. Obviously, local depositional environments have had a great effect on the distribution of coarse- and fine-grained sediments, as indicated by the disparate patterns of sediment distribution in the texture columns, maps, and sections. On the other hand, the effects of regional events, such as glaciation in the Sierra Nevada, are not readily apparent in these illustrations.

Although the texture of the continental rocks and deposits differs greatly over short distances and depths, some areas in the Central Valley are underlain chiefly by coarse-grained sediment and others by fine-grained sediment; for those areas that have like sediment size, sources and depositional environments probably were similar for long periods of time. The thick section of fine-grained sediments underlying

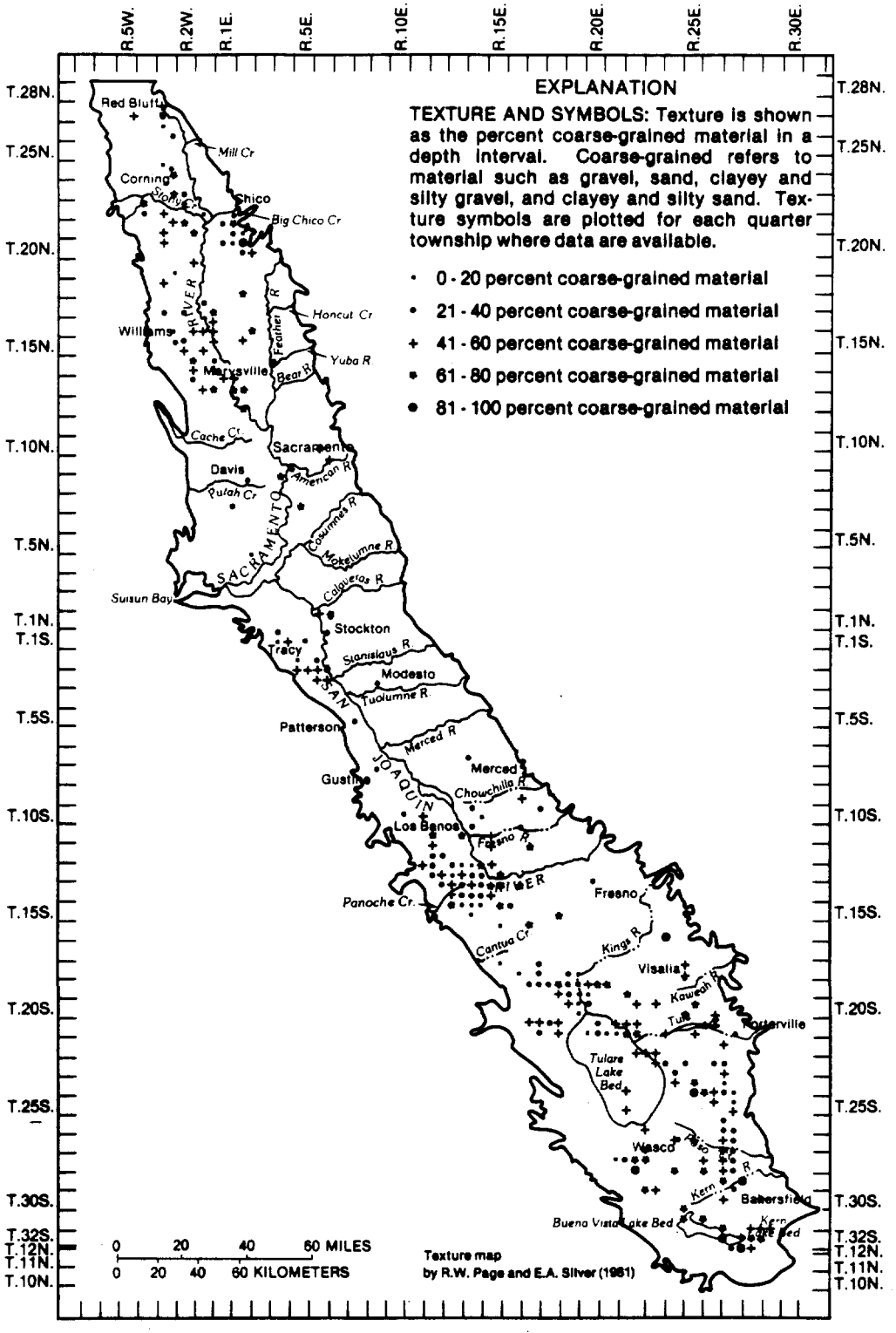

Figure 6. Texture map of post-Eocene rocks and deposits above base of fresh water, depth interval 0 to 300 feet.

Tulare Lake bed is an example. The distribution of thick, coarse-grained sediments north of Sutter Buttes indicates that through time Big Chico Creek, Stony Creek, the Feather River, and their antecedents probably have contributed proportionally more coarse-grained sediment to the Sacramento Valley than has the Sacramento River.

In the Central Valley, most of the rocks and deposits contain no more than 40 to 60 percent coarse-grained sediment, where coarse-grained sediment in-

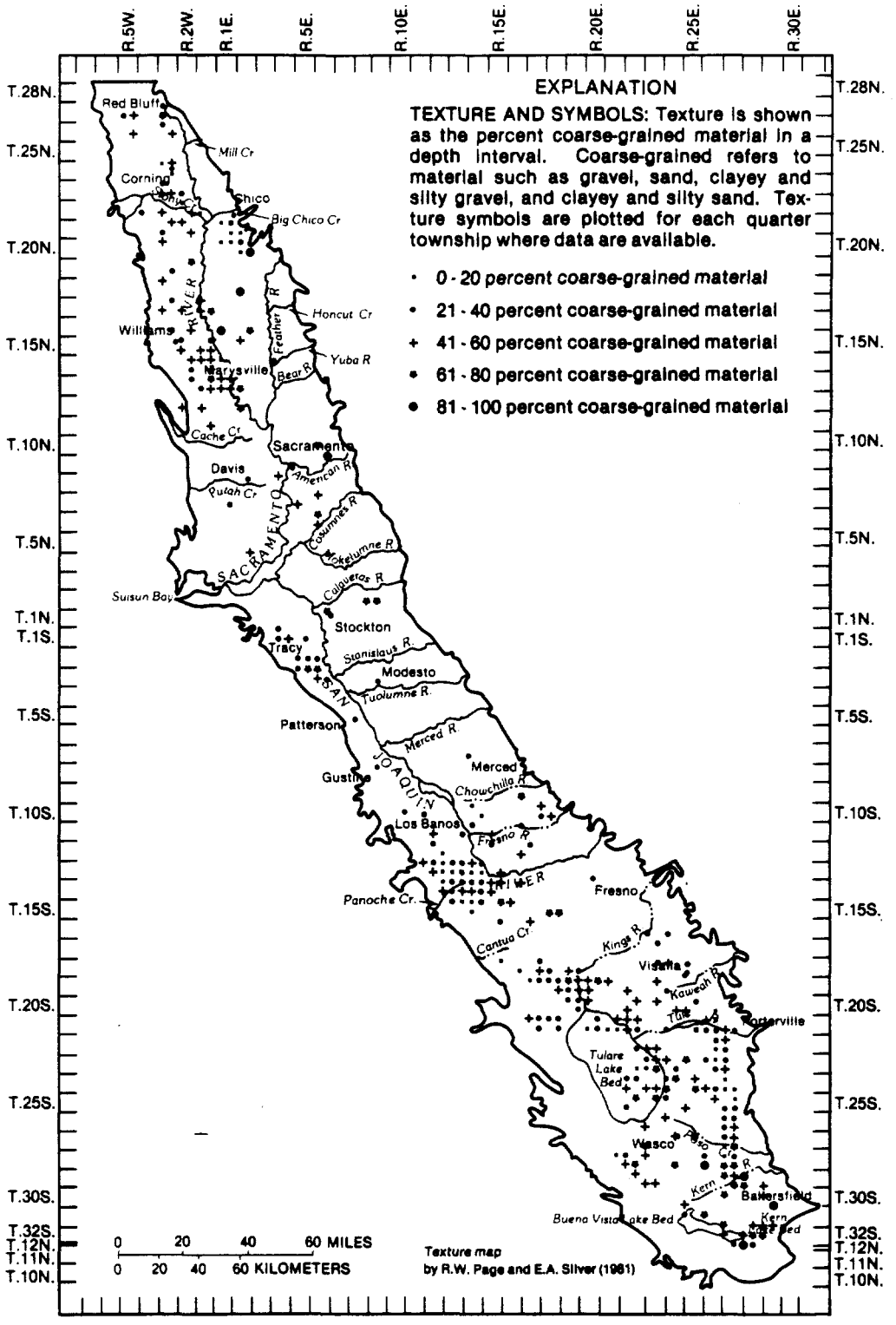

Figure 7. Texture map of post-Eocene rocks and deposits above base of fresh water, depth interval 300 to 600 feet.

udes clayey and silty sand and clayey and silty ravel.

The texture maps and sections could prove useful to ound-water managers as a general guide for selecting st-hole sites and to modelers for assigning values for transmissivity and coefficient of storage with smaller values being assigned to the fine-grained sediments. The maps and sections also could be used as a general guide for locating areas and depths of potential land subsidence.

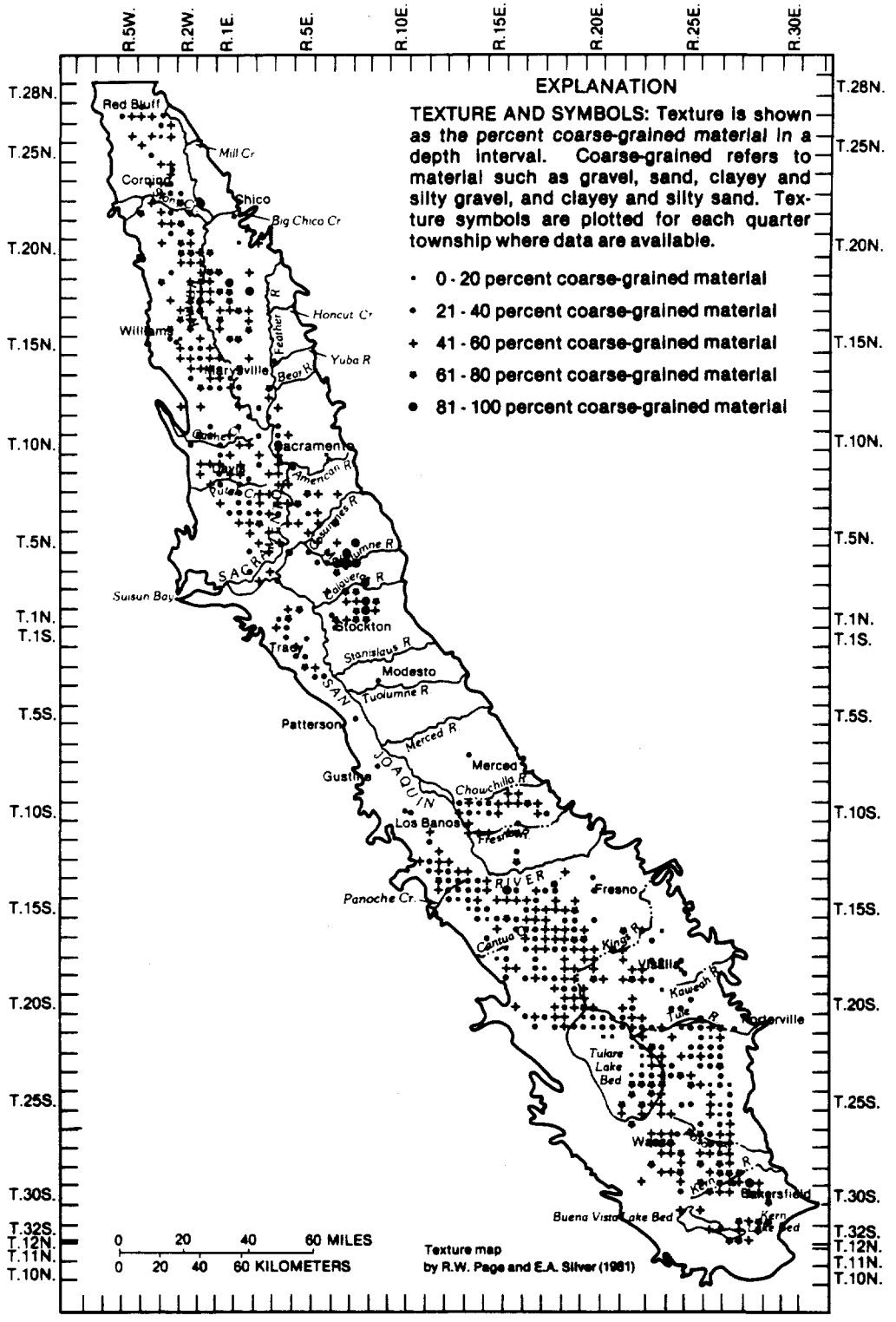

Figure 8. Texture map of post-Eocene rocks and deposits above base of fresh water, depth interval 600 to 900 feet.

Although widespread lacustrine clays have been deposited in the San Joaquin Valley, similar widespread clays probably have not been deposited in the Sacramento Valley. As a result, ground water in the San Joaquin Valley is confined over large areas beneath widespread clays, in addition to unconfined and locally confined conditions, but ground water in the Sacramento Valley is confined probably over relatively small areas beneath clays of only local extent.

CONTACT REPORT

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SUBJECT: Hydrogeological information for the vicinity of Lost Hills		
SITE NAME: Farm Flite Ag. Service	EPA ID: CAD 983650078	

DISCUSSION: Groundwater in the region occurs in two aquifers which are frequently referred to as the "confined" and "unconfined" aquifers. However, Mr. Hasleybacher stated that he did not like to refer to the "unconfined" aquifer as such since it is actually locally and regionally confined. He added that the regional confinement occurs because of the variability in the unconsolidated alluvial sediments which underlie the entire area. These sediments are a part of the Tulare formation and are derived from the marine sediments found in the Coast Range to the west.

Movement of groundwater beneath the site is predominantly to the southwest. Depth to groundwater in Section 36, located immediately east of the site, is 50 feet below ground surface. Mr. Hasleybacher estimated that the depth to groundwater at the site would probably be slightly greater than 50 feet due to the increased elevation at the site. He added that groundwater in the vicinity of Lost Hills is not used for drinking or irrigation purposes.

CONTACT CONCURRENCE: _____ DATE: _____

CONTACT REPORT

REFERENCE 26

AGENCY/AFFILIATION: Lost Hills Utilities District		
DEPARTMENT:		
ADDRESS: P.O. Box 246	CITY: Lost Hills	
COUNTY: Kern	STATE: CA	ZIP: 93249
CONTACT(S)	TITLE	PHONE
Estella Cortez	Secretary/Treasurer	(805) 797-2730
BEI PERSON MAKING CONTACT: Jordie Bornstein AB		DATE: 4/5/93
SUBJECT: Water supply for Lost Hills		
SITE NAME: Farm Flite Ag. Service	EPA ID: CAD 983650078	

DISCUSSION:

The Lost Hills Utilities District supplies drinking water to approximately 1,000 people (200 connections) in the Lost Hills area.

CONTACT CONCURRENCE: _____ DATE: _____

CONTACT REPORT

REFERENCE 27

AGENCY/AFFILIATION: John Carollo Engineers		
DEPARTMENT:		
ADDRESS: 450 North Wiget Lane	CITY: Walnut Creek	
COUNTY: Contra Costa	STATE: CA	ZIP: 94598
CONTACT(S)	TITLE	PHONE
Howard Way	Partner	(510) 932-1710
BEI PERSON MAKING CONTACT: Jordie Bornstein JB		DATE: 5/6/93
SUBJECT: Information on drinking water in Lost Hills		
SITE NAME: Farm Flite Ag. Service	EPA ID: CAD 983650078	

DISCUSSION:

Mr. Way explained that the drinking water in Lost Hills is supplied by wells. However, the wells are located 13 miles east of the town of Lost Hills and the water is transported through a pipeline. Mr. Way stated that water being drawn from areas further west of these wells is generally not suitable for drinking purposes. Mr. Way referred me to John Johnson, in their Bakersfield office at (805) 665-0116, for more information.

CONTACT CONCURRENCE: _____ DATE: _____

CONTACT REPORT

REFERENCE 28

AGENCY/AFFILIATION: Lost Hills Water District		
DEPARTMENT:		
ADDRESS: 3008 Sillect Avenue	CITY: Bakersfield	
COUNTY: Kern	STATE: CA	ZIP: 93308
CONTACT(S)	TITLE	PHONE
Phil Nixon	Manager	(805) 633-9022
BEI PERSON MAKING CONTACT: Jordie Bornstein JB JJ.		DATE: 4/7/93
SUBJECT: Information on the California Aqueduct		
SITE NAME: Farm Flite Ag. Service	EPA ID: CAD 983650078	

DISCUSSION:

The California Aqueduct is an open-air, concrete-lined canal which runs through Lost Hills on its way from Northern to Southern California. The aqueduct is fenced on both sides and thus, is not accessible to the public. Mr. Nixon was aware of an historical public access area for the aqueduct. To the best of his knowledge, Mr. Nixon thought that the access area was located near where the aqueduct intersects Lost Hills Road; however, he was not certain of the location or whether the public access area currently exists. The Department of Water Resources may have more information on issues of public access and flow rates for the aqueduct.

Within the Lost Hills Water District, the water in the canal is used for agricultural purposes only. Mr. Nixon thought that aqueduct water was not used for drinking purposes at all until it reached Southern California.

CONTACT CONCURRENCE: _____ DATE: _____

CONTACT REPORT

REFERENCE 29

AGENCY/AFFILIATION: California Department of Water Resources		
DEPARTMENT: San Joaquin Field Division		
ADDRESS: 4201 Sabodan Street	CITY: Mettler	
COUNTY: Kern	STATE: CA	ZIP: 93313
CONTACT(S)	TITLE	PHONE
Dee Bankston	Water Services Supervisor	(805) 858-2211
BEI PERSON MAKING CONTACT: Jordie Bornstein JB		DATE: 4/26/93
SUBJECT: Stream flow data for the California Aqueduct near Lost Hills		
SITE NAME: Farm Flite Ag. Service	EPA ID: CAD 983650078	

DISCUSSION:

Flow rates for the California Aqueduct vary from a maximum of 5,000 cubic-feet per second to a minimum of 400 cubic-feet per second. Mr. Bankston estimated that, on average, the aqueduct pumps 2.5 million acre-feet of water per year - a flow rate equivalent to 3,000 cubic-feet per second.

CONTACT CONCURRENCE: _____ DATE: _____

CONTACT REPORT

AGENCY/AFFILIATION: Department of Fish and Game		
DEPARTMENT:		
ADDRESS: 1234 East Shaw	CITY: Fresno	
COUNTY: Stanislaus	STATE: CA	ZIP: 93710
CONTACT(S)	TITLE	PHONE
Tim ~~Hine~~ Heyne	Associate Biologist (Marine/Fisheries)	(209) 222-3761
BEI PERSON MAKING CONTACT: Jordie Bornstein JB JB		DATE: 4/14/93
SUBJECT: Information on surface water bodies and endangered species in the vicinity of Lost Hills		
SITE NAME: Farm Flite Ag. Service	EPA ID: CAD 983650078	

DISCUSSION:

Although the California Aqueduct is fenced and is not accessible to the public, Mr. ~~Hine~~ Heyne is aware that instances of illegal fishing have occurred.

The Kern River Channel periodically contains water; however, Mr. ~~Hine~~ Heyne thought that it was used as a canal for agricultural interests ~~only.~~ He stated that there has not been any water in the canal for the past 5 or 6 years. This should be confirmed by the water agencies. it is likely a flood basin

Mr. ~~Hine~~ Heyne stated that he will attempt to locate a game warden who is more familiar with the Lost Hills area in order to get a more accurate picture of recreational fishing on both of these water bodies. He also suggested I contact the Department of Water Resources for stream flow data and information on water use.

Two endangered species, the blunt nosed leopard lizard and Tipton kangaroo rat are listed in the Natural Diversity Database as being within 1 mile of the site. Due to the site characterization as a grassy field surrounded by agricultural lands, Mr. ~~Hine~~ Heyne thought it was reasonable to assume that these species might actually be found on the site itself.

Mr. Heyne recomends that Bechtel (Jordie Bornstein) contact the Environmental Services Division of CDFG at (209) 445-6152 to discuss the project with that ~~Branch~~ Division of ~~one~~ CDFG! Jeff Single!

CONTACT CONCURRENCE: _____ DATE: 4/20/93

~~906 00014~~
906 00023

CONTACT REPORT

REFERENCE 31

AGENCY/AFFILIATION: California Department of Water Resources (DWR)		
DEPARTMENT: Groundwater Data Unit		
ADDRESS: 3374 East Shields Ave.	CITY: Fresno	
COUNTY: Fresno	STATE: CA	ZIP: 93726-6990
CONTACT(S)	TITLE	PHONE
Dennis Williams	Chief	(209) 445-5038
BEI PERSON MAKING CONTACT: Jordie Bornstein JB		DATE: 4/14/93
SUBJECT: Groundwater and surface water information for Lost Hills		
SITE NAME: Farm Flite Ag. Service	EPA ID: CAD 983650078	

DISCUSSION:

The Kern River Channel does not normally have water in it except after an exceedingly wet winter. Due to the channel's intermittent nature, Mr. Williams estimated that there would be a limited number of fish being caught along the channel.

Historically, wells in the area were drilled to 20 or 30 feet and were used for the watering of stock by sheep herders. However, most of these wells were closed down with the construction of the California Aqueduct which provided sufficient water to bring agriculture into the area. Mr. Williams stated that there are few groundwater wells remaining in the area. He will check the DWR files and see if he can find any historic well logs for the Lost Hills Airport located at Township 26 South, Range 21 East, Section 35.

The DWR has a maintenance yard for the California Aqueduct located in Lost Hills. Mr. Williams thought that the San Joaquin Field Division, Engineering Department, might have stream flow data for the aqueduct.

CONTACT CONCURRENCE: Dennis Williams DATE: 4/20/93

CONTACT REPORT

AGENCY/AFFILIATION: Kern County Planning Department		
DEPARTMENT: Engineering and Survey Services, Flood Plain Management		
ADDRESS: 2700 M Street, Suite 100	CITY: Bakersfield	
COUNTY: Kern	STATE: CA	ZIP: 93301

CONTACT(S)	TITLE	PHONE
John Usfery	Engineer	(805) 861-2615

BEI PERSON MAKING CONTACT: Jordie Bornstein	DATE: 4/8/93
SUBJECT: Flood zone information for Lost Hills Airport	
SITE NAME: Farm Flite Ag. Service	EPA ID: CAD 983650078

DISCUSSION:

According to Mr. Usfery, the entire Lost Hills Airport is located in Flood Zone C, which designates an area with a flooding frequency greater than 500 years. The information was taken from FEMA map for Community 060075, Panel 0375 B. The effective date of the map is September 29, 1986.

CONTACT CONCURRENCE: John Usfery DATE: 4/30/93

Information extracted from:

U.S Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service, Atlas 2, Volume XI, Isopluvials of 2-year, 24-hour Precipitation for Southern Half of California in Tenths of an Inch.

CONTACT LOG (Cont'd)

Site: Farm Flite Ag. Service

Name	Affiliation	Phone	Date	Information
Estella Cortez	Lost Hills Utilities District	(805) 797-2730	4/5/93	See Contact Report.
Operator	Information 805 area code	(805) 555-1212	4/6/93	No listing for a Marion Goolsby in Cambria, Calif.
Phil Nixon	Lost Hills Water District	(805) 633-9022	4/7/93	See Contact Report.
Brian O'Kelly	Kern County Fire Department	(805) 797-2308	4/8/93	See Contact Report.
John Usfery	Kern County Planning Department	(805) 861-2615	4/8/93	See Contact Report.
Peter W. Smith	Kern County Council of Governments	(805) 861-2191	4/8/93	See Contact Report.
Tim Heyne	Department of Fish and Game, Southern District	(209) 222-3761	4/14/93	See Contact Report.
Dennis Williams	California Department of Water Resources	(209) 445-5044	4/14/93	See Contact Report.
Frank Day	Kern County Department of Airports	(805) 393-7990	4/14/93	Residents at the Lost Hills Airport are Jose and Gloria Mora. Their home number is (805) 797-2242 and work number (805) 797-2664. They live in and own a mobile home located near the runway and apron.
Señora Mora	House at Lost Hills Airport	(805) 797-2242	4/14/93	The Mora family, Gloria, Jose and their two children, live in the trailer unit near the runway.

Information extracted from:

U.S. Environmental Protection Agency, Office of Toxic Substances, Graphical Exposure Modeling Systems (G.E.M.S.) Database, General Sciences Corporation, 1983 Population Estimates, March 1989.

Information extracted from:

California Department of Fish and Game, Natural Diversity Database, 1991.